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SONS OF THE BLUE PLANET

Lebedev
Luk'yanov
Romanov

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Yu A GAGARIN
G S TITOV
A G NIKOLAEV
P R POPOVICH
V F BYKOVSKII
V V TERESHKOVA
V M KOMAROV
K P FEOKTISTOV
B B EGOROV
P I BELYAEV
A A LEONOV
G T BEREGOVOI
V A SHATALOV
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E V KHRUNOV
G S SHONIN
V N KUBASOV
A V FILIPCHENKO
V N VOLKOV
V V GORBATKO
V I SEVAST'YANOV

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L Lebedev
B Luk'yanov
A Romanov

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The daring wish of mankind was, and still is, to look at the earth from a sufficient height to be able to encompass the whole of it at a glance, and to find out what lies in the depths beyond the blue dome of the sky. This interest, this desire to apprehend what surrounds the world, is a mighty and unquenchable thirst, which leads humanity from one step in its development to another, higher one.

Today when much arm-chair talk is going on about the Apollo Moon missions, the first exciting events toward mastering outer space seem to have lost their glamor. Indeed the beginning of the space era is to be traced to the launching of the first artificial earth satellite into the orbit. Manned flights in spacecraft started with the historic flight of Yurii Gagarin. Since then tremendous advances have

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SONS OF THE BLUE PLANET

1961
1971

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(Syny Goluboi Planety)

L. Lebedev, B. Lyk'yanov, A. Romanov

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DEDICATED TO
THE GLORIOUS ACHIEVEMENTS
OF THE WORLD'S FIRST
ASTRONAUT,
YURII ALEKSEEVICH GAGARIN

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THE SHORE OF THE UNIVERSE

by Academician B.N. Petrov,
Hero of Socialist Labor

THE daring wish of mankind was, and still is, to look at the earth from a sufficient height to be able to encompass the whole of it at a glance, and to find out what lies in the depths beyond the blue dome of the sky. This interest, this desire to apprehend what surrounds the world, is a mighty and unquenchable thirst, which leads humanity from one step in its development to another, higher one.

By starting the construction of a socialist State, our nation had entered a new stage of social development before anyone else in the twentieth century. After forty years this very nation sent the first artificial earth satellite into space in October 1957 and thus marked the beginning of the cosmic era.

In those portentous days, through the lips of its great son, Frederick Joliot-Curie, humanity triumphantly exclaimed, "Man is no more chained to his planet" and the forecast of another great son of our land, K.E. Tsiolkovskii: "The planet is the cradle of reason, but one cannot live in a cradle for ever...Humanity will not remain on the earth eternally" was corroborated.

The first people to dare leaving this "cradle" were our compatriots Yurii Gagarin and German Titov.

After them the feat was accomplished by an American, John Glenn. Already almost fifty Soviet and American astronauts have lived and worked in outer space.

Hardly fifteen years have passed since the launching of the first artificial earth satellite. But they were anticipated by decades of strenuous labor by many scientists throughout the world, whose labors both theoretically and practically made possible the great event which took place on April 12, 1961. This remarkable evidence of the triumph of human reason over the forces of nature was preceded by the efforts of millions of people who created all the earthly riches necessary for the success of the scientific-technological revolution.

Our country is the birthplace of astronautics. The first ideas of challenging outer space were born here and also the first important steps in conquering outer space were taken. These historical achievements of the Soviet people were realized due to the fact, that under the guidance of the Leninist party, mighty industry with its highly developed modern equipment and well-organized industrial complexes were established in our first-ever socialist country. Also because the unprecedented and astounding pace of the development of science resulted in the Soviet Union occupying the leading place in many fields in the world.

The development of science and technology in the young socialist State can be traced back to the famous "Outline of the plan for scientific-technological works", written by Lenin in April 1918. The outline was followed by concrete measures, promoting the development of scientific activities in the country, helping to solve the basic problems of industrialization, socialistic reorganization of rural economy and carrying out the cultural revolution. Lenin familiarized himself in detail with the ideas of K.E. Tsiolkovskii during the first years of Soviet power. This great scientist laid the theoretical foundation of astronautics, putting forward the ideas of modern rocket propellants, multistage rockets, orbital stations and interplanetary communications. The Council of the Soviet People's Commissars passed a resolution on November 9, 1921, which decreed: "To grant a life-long pension to K.E. Tsiolkovskii in view of his special services as a scientist-inventor, specialist in the field of aviation..." The resolution was signed by Lenin. By this act the Workers and Peasants' Government not only acknowledged the vitality and perspicuity of the scientific views of the scholar, but also directed the attention of the general public toward the problems of astronautics. It is known that Lenin also showed interest in the works of another outstanding scholar, F.A. Tsander, who was a close follower of K.E. Tsiolkovskii.

The care taken of the "Kaluzhskii dreamer" by the Soviet Government

and the attention paid to his works, helped in popularizing K.E. Tsiolkovskii's ideas. At the beginning of the 20's, and later the 30's, the first organizations uniting the supporters of K.E. Tsiolkovskii's ideas sprang up in our country. Research centers, realizing his ideas as far as feasible at that time, were also set up. These were the dynamic laboratory in Leningrad and the group for the study of jet propulsion in Moscow. In 1933, the Jet Propulsion Research Institute was opened. Work in the field of jet propulsion and space technology got the biggest boost in the postwar years. Design organizations, scientific laboratories and experimental bases were created and specialists were trained. Because of all this, after a short while it was possible to start complex research leading to the development of first class rocket and space techniques.

The Communist Party and the Soviet Government supported the progressive ideas of Soviet scholars, which were directed toward space research to be utilized in the interest of scientific-technological progress. It was then that the exceptional talent of the Soviet designer and organizer S.P. Korolev became fully apparent. He, with other scientists and engineers, laid the foundations of rocket-space technology in the country, and also ensured its intensive development. Their work established the precedence of the Soviet Union in the basic stages of man's penetration into space.

This relates not only to the successful flights of manned craft of the "Vostok", "Voskhod", and "Soyuz" types, but also to the creation of mighty rocket propellants, the rockets themselves, innumerable space apparatus for various scientific purposes—automatic stations: "Luna", "Venera", "Mars", and "Zond", scientific laboratories: "Proton", and "Elektron" and the series of satellites: "Cosmos", "Molniya", "Meteor", etc.

Consistent and purposeful research of outer space led to outstanding discoveries in the field of fundamental science and the understanding of the universe, its structure and the processes taking place in space and on cosmic bodies and progress in the study of sun-earth relations, which has exceptional influence on our life. The satellites also help in solving problems important for the national economy.

In the study of outer space, the moon and other celestial bodies of the solar system, an important role belongs to automatic apparatus. Perhaps more in space than in any other sphere of human activity, they are preparing the way for man. Automatic craft, whose capabilities are growing every year, are the real reconnoiters of the universe.

At present astronautics is on the eve of establishing permanent orbital stations whose importance is extraordinarily great. In short, humanity is stepping into a new era of study of the universe and also of planned utilization of outer space in the interest of progress on the earth.

For the first time, in January 1969, Soviet scientists launched an experimental station into orbit around the earth. The day is not far when

manned space stations working for prolonged periods will start their flights. This type of station has enormous importance for the progress of science and technology. It will be used for meteorological research, geological prospecting, communications, navigation, scientific experiments and the study of interplanetary medium, etc. The orbital stations will mark the beginning of a fruitful stage in the conquest of the universe.

Enormous opportunities for the development of geophysics, astrophysics, astronomy, medicine, biology and space-technology are provided by the transfer of scientific research and experiments directly into space. Humanity will be enriched by new discoveries and scientific achievements.

Sergei Pavlovich Korolev liked to call the earth "the shore of the universe". It is exactly this. In ever larger numbers the sons of our blue planet will be carried vast distances by spacecraft. These very people will become the first inhabitants of the orbital stations and later of the heavenly bodies. Gradually, as predicted by K.E. Tsiolkovskii, they will settle down in space around the sun.

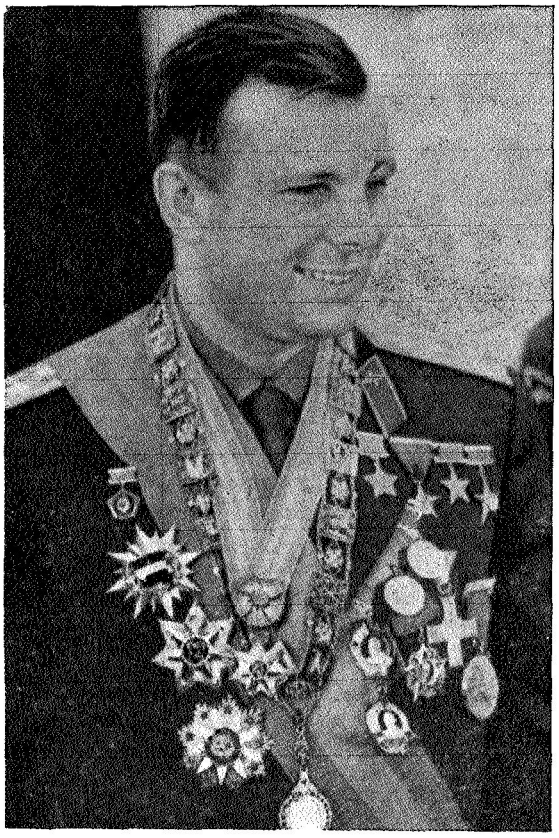
Now everyone has acknowledged that space research is a new stage not only in the development of the science of the universe, but of science in general. This is wonderful evidence of the unlimited possibilities of human reason and of man's control over the forces of nature.

But whatever successes are achieved and to whatever inconceivable depths of space man may go, we can never forget those people who took the first steps into the unknown, who overcame earth's gravity and who, risking their lives, studied and mastered outer space in the name of progress.

Scientists show special respect for the conquerors of outer space. Their flights, their life and their work in interplanetary space are the culmination of many years of labor of hundreds of scientific bodies, and thousands of engineers and workers, who created the space equipment.

The book in your hands is devoted to the decade since the day of the historic flight by Yurii Gagarin. The book tells about all the Soviet astronauts, their lives, aspirations and exploits. One chapter is devoted entirely to Yurii Alekseevich Gagarin. The presence of Gagarin is felt throughout the book, because the Gzhatsk boy, who started the starry hour of humanity, lives on in the deeds of his space comrades. For all who strive to multiply our successes in understanding and conquering the universe with their efforts and knowledge, Gagarin's name will always remain the guiding star for centuries to come.

1961—1971

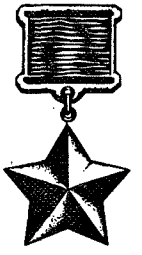


Yurii Alekseevich Gagarin,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On April 12, 1961, in the Soviet Union, the world's first spacecraft-satellite "Vostok", with a man on board, was put into orbit around the earth.

The pilot-astronaut of the spacecraft-satellite "Vostok" was Air Force Major, Yurii Alekseevich Gagarin, a citizen of the Soviet Union.



"Vostok"

For a heroic first flight into outer space, that has brought glory to our socialist country, and for displaying courage, valor, fearlessness and selfless service to the Soviet people, to the cause of communism and to the cause of human progress, the title of Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon the world's first Pilot-Astronaut, Major Yurii Alekseevich Gagarin.

According to the decision of the Presidium of the Supreme Soviet of the USSR, a bronze bust of the hero has been installed in the city of Moscow.

* * *

For making the world's first outer space flight in the spacecraft-satellite "Vostok" the title of "Pilot-Astronaut of the USSR" is conferred upon Air Force Major Yurii Alekseevich Gagarin, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

The first pilot-astronaut in history, Yurii Alekseevich Gagarin, was born on March 9, 1934 in the family of a collective farmer in the village of Klushino in the Gzhatsk district of Smolensk region.

In 1941 he joined school, but his studies were interrupted by the Nazi invasion.

After the Second World War, the Gagarin family moved to the town of Gzhatsk. There Yurii continued his studies in the higher secondary school. In 1951 he finished with honors the vocational school in the town of Lyubertsy near Moscow, specializing as a moulder-smelter. He also finished the working youths' school. At the Saratov Industrial Technical School, the young man got his honors diploma.

When he was still studying in technical school, Gagarin took his first step in aviation by joining the flying club. After the flying club he joined the Orenburg Aviation College in 1955. From 1957 he started working as an Air Force pilot.

Gagarin also completed the Zhukov Air Force Engineering Academy.

In 1960 Yurii Gagarin was admitted to the ranks of the Communist Party of the Soviet Union.

He was elected as a Deputy of the Supreme Soviet of the USSR by the people.

Yurii Alekseevich died on March 27, 1968 in an aircraft accident during a training flight.

IN OUR HEARTS

It is difficult to call his house a museum, yet everything that is preserved in it is a museum-exhibit. Every object and every document does not merely tell us about the past: they also have the brightness and exuberance of continuing life.

It is enough to look at the faces of the visitors, particularly the youngsters to understand how great is their excitement and how happy they feel when they get acquainted with everything that belonged to Gagarin, the things that speak about the various periods of his life.

...Here, within these walls grew the future astronaut. Here, in this small house on a quiet street of the old Gzhatsk, lived his parents. Old Gzhatsk now appears as Gagarin Town in all the maps and atlases. This name will always remind us of the man who commanded the first spacecraft to the stars.

Let us go around the rooms of the house, a five-walled peasant's home. Let us go together with Yurii Alekseevich's mother, Anna Timofeevna, and father, Aleksei Ivanovich. The astronaut's brothers, Boris and Valentin,

and sister Zoya will also accompany us. Yurii's wife Valentina Ivanovna Gagarina cannot hide her feelings. She hugs her two daughters Lenochka and Galochka and keeps her silence...

At once a photo comes before our eyes: a smiling father embracing his little daughters, and they are kissing him on the cheeks...

Astronaut German Titov accompanies the family of his friend. He went to the launching of the "Vostok" with Gagarin and also gave his comrade a warm reception on returning back to earth. And when he himself went on a flight, he became aware of the special strength of Gagarin's warmth and anxious concern.

The first stand of the memorial museum is named: "Gagarin is the son of the Smolensk soil". There is a photo of four-year old Yura. Then there are photos of his paternal house, school, class, family, and childhood friends. A page from an essay on the topic "My favorite book" tells us about the special liking of the author for people with strong willpower. There is an Honors Certificate, given by the Lyubertsy middle school for working youth.

The professional-technical school No. 10 of Lyubertsy, where Yurii studied, has sent his working instruments and documents.

The next page in the life of the young man is connected with studies at the Saratov Industrial Technical School. We read Gagarin's words: "It is with Saratov that the appearance of a disease in me, which has no name in medicine, is connected: an irrepressible craving for the sky, an irresistible craving for flight." In the photo Yurii is shown on the wing of a plane, in the uniform of a cadet of the Aviation College.

"Gagarin is the embodiment of the eternal youthfulness of our people", said Sergei Pavlovich Korolev. The exactness of these words can be felt here, in the house-museum.

Here is a report of fighter pilot Yu.A. Gagarin to the commander of the military unit. This report may be called his first step on the outer space path. Every line speaks about the firm decision of the pilot to dedicate himself to the study of outer space.

Yurii wrote, "People may be required for the first flights in space in connection with expanding space research in the Soviet Union. It is requested that my strong desire for the same may be favorably considered and, if possible, I may be sent for special training".

Other new stands: their very names give an idea of the events which have become a part of history. "A step in the direction of immortality", "The motherland greets the hero", "Orbits of peace and friendship". Gagarin's personal effects, presents to the astronaut, medals presented by several countries to honor the flight, photographs of endless meetings at home and abroad, are all here.

German Titov wrote in the visitors' book, "It is great that a memorial

museum has been set up in the house where Yurii passed his childhood. The man of the universe started the remarkable journey of his life here, and the exhibits convincingly narrate how Yurii traveled his path to the stars".

* * *

The opening of the Gagarin Museum is an important event for humanity, since Gagarin accomplished his feat for the sake of us all, for science, progress and in the name of a brighter future.

Time is passing. Whatever Gagarin said, whatever he wrote, has now become a part of history. For us, reminiscences of meetings and conversations with the hero increase in value. Their number is large and the last one was at a reception, held on the occasion of the 50th anniversary of the USSR Armed Forces.

The banquet hall of the Kremlin Palace of Congresses was glittering not only with the lights, but also with the golden stars of decorations. Famous military leaders, the pick of the Army, Navy, and Air Force were assembled there. Every man present was a part of our history and of our victories on land, sea, and air. Many pilot-astronauts grew in the ranks of our Air Force. They continue to serve the country.

Colonel Gagarin stood with a big group of guests. We came up to congratulate him. Laughter, jokes could be heard. Glasses were raised.

Yurii Alekseevich cracked a joke, saying if we want to talk with him, we must make an appointment. "Without an appointment I do not receive people" he chuckled. The conversation became general...

Could anyone think then, that only a month later the terrible news 'Gagarin is dead' would strike pain in our hearts? The stream of people coming to the Central House of the Soviet Army seemed endless. In the hall, decorated with the Order of the Red Banner, urns with the ashes of Gagarin and Seregin were kept. There was a portrait of Yurii Alekseevich in ceremonial uniform, with decorations. We also have this portrait with his affectionate autograph.

It is hard to accept the fact that Gagarin is no more. He always stands before us, cheerful, cordial, hospitable...

...The familiar voice was speaking on the phone.

"Do you want to come? Make it tomorrow."

"What time?"

"Any time. I'm at home all day. O.K., come in the morning."

Since it was Sunday, we decided to reach about ten so our hosts could have some time to rest.

The familiar door. Valentina Ivonovna met us, "Please, take off your coats, Yura is still not up. Yesterday we had some guests, friends from the

north. We sat up till three in the morning. Come on over to Yura's study. He will be up soon".

The girls ran out. They want to see who has come. The domestic study of the first astronaut is very simple. On the wall a portrait of K.E. Tsiolkovskii is hanging. A writing table with a fountain pen set in the shape of a rocket. It has a presentation inscription by the workers of a factory. Perhaps this is the only detail in Gagarin's flat that reminds one about space. There is a bookcase, full of books...

In this room Yurii Alekseevich does his Deputy's work, replying to voters' letters, writing to various organizations in connection with the people who made him their Deputy. The number of letters received is very great; they come not only from the electorate, but from all over the country.

An hour or two pass and the student of the N.E. Zhukovskii Air Force Engineering Academy, astronaut Gagarin starts studying text books. In copy books mathematical formulas start appearing. English speech can be heard.

Space training is now imparted on the basis of solid scientific and engineering knowledge. Gagarin and his comrades are equipped with a comprehensive understanding of the laws of mathematics, physics, mechanics and the laws of dialectical materialism. Pilots also undergo courses on the theory and practice of programing.

Yurii Gagarin takes his studies at the Academy seriously and with enthusiasm, since he well understands its importance for his work. Once, giving his appraisal of the creative capacity of the astronauts, Academician Korolev said, "In Gagarin we find a happy combination of analytical mind with exceptional diligence. I think if he receives sound education, we will hear his name among the most famous names of our scientists."

Yurii Alekseevich appears and his world-famous smile immediately brightens the atmosphere.

"Please excuse me, guests have arrived unexpectedly. My ex-group commander Leonid Danilovich Vasil'ev with his wife. I will introduce you just now. For the time being, a small introduction. Leonid Danilovich is an excellent man. For me and for all the young fighter pilots he was not simply a boss, oh no! He was a model of bravery, tenacity and flying skill. Let's go and get acquainted."

Thus we became participants in a small family celebration. Glad to see each other again, Gagarin and Vasil'ev spend the time reminiscing.

Yurii Alekseevich depicted with his face, how he flew to Moscow for his "Space Commission" on the orders of the Commander-in-Chief of the Air Force. His mimicry evoked friendly laughter.

"First I was flown on an LI-2 aircraft. Later I had to change over to another plane. I ran into the airport, after the pilot had already started the engines. I stood in front, waved my hands over my head and started

shouting that they should take me aboard. It was ordered that I should fly by this plane.

"The pilot cut the engines, let me in, and then started yelling at me. It transpired that mist had started covering our destination. Had I come earlier the boys would have gained fifteen minutes. I also assumed the offensive and told them, 'My name is right there on your flight list. If you hadn't taken me, you would have had to answer how you lost me.'

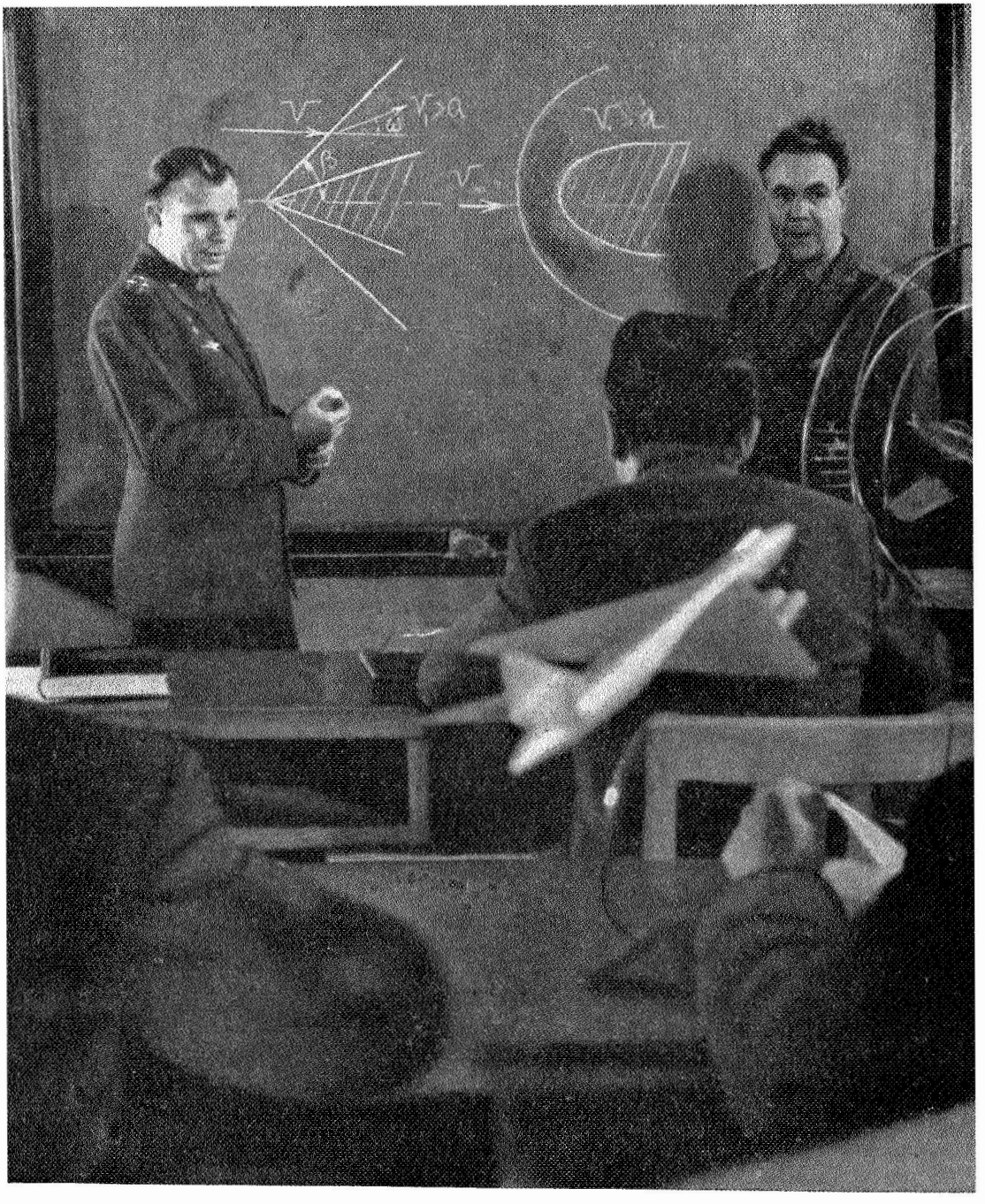
"When we came in to land the mist had thickened and two approaches had to be made, but all the same we landed. The commander of the plane showed great skill."

Yurii Alekseevich joked and laughed a lot. A number of times he got up to help his nephew Yura, who was busy with the cinema projector. Yura is Gagarin's sister Zoya Alekseevna's son. These days she had come to visit her brother. Gagarin spoke with the young Suvrovets, as if with an equal and he was very happy...

Now we have a spare minute, let's go on a tour of the flat. It reminds one of a unique "museum of presents" of the peoples of the world. If the astronaut thought of keeping all the presents at home, it would be impossible to move freely. Yurii Alekseevich visited more than 30 countries. In a corner, near the bookcase, there is a pile of albums.

Let us turn over the pages of one of them. Here is Yurii Alekseevich in ceremonial uniform with all his decorations and medals. How many high titles and awards does Gagarin have! Besides Hero of the Soviet Union—he is Hero of Socialist Labor of the Czechoslovak Socialist Republic and the People's Republic of Bulgaria and also Hero of Labor of the Democratic Republic of Vietnam. In Hungary the astronaut was awarded the Order: "Banner of the Hungarian People's Republic First Class, with Diamonds," in Poland—the Order "Grunwald Cross First Class," and in the German Democratic Republic—the Order of Karl Marx. Yurii Gagarin became the first bearer of the recently instituted order of "Plaiya Hiron" in Cuba, which commemorates distinguished service in the struggle for freedom and independence of the people, for peace and progress of humanity. In Indonesia he was awarded the Star of Second Class. In the United Arab Republic the highest Order, "Necklace of the Nile", was pinned on the tunic of the Soviet astronaut, and in Liberia the Order of "The African Star". Brazil rewarded the first discoverer of outer space with the Order "For Services in the Field of Aeronautics", its highest distinction for officers of Brazilian aviation. In Great Britain, Yurii Alekseevich was given the Gold Medal of the British Interplanetary Society and in France, the "International 'Galaber Prize' in Astronautics for 1962" for his distinguished services in the study of outer space, and these are only a few of his honors.

But there are other rewards which are priceless. What can be dearer than the fact that fathers and mothers give your name to their children!



Yu.A. Gagarin at the time of lessons in the Zhukovskii Academy.

On the day of the flight, April 12, 1961, John Kin, the Secretary of the African National Union of Kenya, had a son. In honor of the Soviet hero the parents gave him the name Yurii. When the child's father came to Moscow, on meeting him Gagarin said, "I wish your son good health and want that he should also go on a space flight".

The earthly "orbit of friendship", as the foreign travels of Soviet astronauts are called, run into hundreds of thousands of kilometers. Gagarin's was the longest of all.

"Let's listen to some music", Yurii Alekseevich suggested to his guests.

Known and unknown melodies ring out, as Gagarin listens, sometimes beating time with his hand. A new tape. Two children's voices sing a Pioneer's song.

"Can you recognize it? This is 'the Gagarin Sisters' duet!' During the summer my daughter lived in the 'Artek' camp and learned all the Pioneer songs by heart".

We had to take Gagarin's photo for some common Krasnoyarsk acquaintances. The astronaut had made friends with them at the time of a rally of construction workers from Siberia and the Soviet Far East.

While Yurii Alekseevich was busy signing one photo after another, we recalled our journey together to the construction site of the Krasnoyarsk Hydroelectric Station.

"Enchanting scene!", said Yurii Gagarin, "Having gone up a hundred meters, we saw a panorama of the dam of the hydroelectric station.

The words of a huge slogan were addressed to the construction workers: "You will raise the Leninist flag over this mighty river".

Later, fitters, concreters, excavator drivers, crane drivers and truck drivers gave a warm welcome to Gagarin. Yurii Alekseevich was greatly interested in the details of construction.

"Sure, I'm not a construction worker, but a smelter", he said, "all the same I understand your pride. It's great to see the results of one's labor."

Equipped with a spade, the astronaut put the memorial plaque in the right-bank pit and took part in the stowage of the first cubic meter of concrete in that part of the dam of the hydroelectric station, where the power house was to be built...

"Well, the autographs are over", said Gagarin. He signed with pleasure. "They are good boys—the construction workers. I will never forget the team of concreter Ivan Golev. In a tent on the banks of the Yenisei River there lived together ten Russians, six Ukrainians, three Tartars and one Daghestanian. Even during bad weather they were stowing in the foundation of the dam one and a half times over the expected quota. This team called upon the construction workers to complete the station one year before the date".

"I am very glad that Ivan Golev and his comrades elected me honorary

member of their team. They have decided to fulfill my quota and give my share of the money to the peace fund. Such people could only be born in our country..."

Yurii Alekseevich continued his reminiscences, "From Krasnoyarsk I flew to Paris. There at the time of a meeting with the workers I spoke about the young construction workers of the Golev team. They listened to me with great attention and then applauded. They applauded those boys who look at construction as the aim of their life. My friends decided to come over to the construction site of Sayan-Shushenskii after the completion of Krasnoyarsk Hydroelectric Station with their full team..."

The phone started ringing. It was the local phone, which meant somebody from the "Star City" was speaking.

After finishing his phone conversation, Yurii Alekseevich observed, "That was Boris Volynov. Know him?"

"Yes. We met a number of times at the cosmodrome and in town".

A thought struck us. It would be nice to hear something about Volynov from Gagarin. His opinion of a senior comrade, and at the same time his leader, would be very valuable, the more so because Boris Volynov was a veteran of the detachment.

"Yurii Alekseevich! Please tell us about Volynov. It will be useful to us for future reference. You yourself know that, sooner or later, we will have to write about Boris Valentinovich, and now we have such a rare opportunity to start."

"O.K.!" agreed Gagarin. "But one good turn deserves another. Later you will have to help me in a literary matter."

We agreed and took out our notebooks.

"Can't we do without the notebooks? I can never get used to your instrument of torture. When one speaks and sees that everything is being taken down, one feels out of sorts. At the time of press conferences I usually look straight into the faces of the correspondents and take no notice of their notebooks."

"It is difficult to speak about friends, because I'm afraid of over-praising," observed Gagarin, "However Boris is such a fine man that he won't be swept off his feet by my praise."

The first astronaut told us a number of interesting details about Volynov, which really proved useful for us at another time.

"I have worked for you, and now you should work for me," joked Gagarin. "The Publishing House of Political Literature is preparing a collection about the Red Square to be called 'Our Main Square'. I have jotted down something for my article. Listen and tell me if it's of any use. It's very difficult for me to decide how to begin: with the visit to the Red Square before the flight or with the meeting on the day of my return to Moscow."

Yurii Alekseevich took out from the writing desk a few sheets covered

The first astronaut puts concrete in the foundation of the State Museum of the History of Astronautics in Kaluga town.

with legible roundish handwriting and started reading, "It is possible to say much about the difficulties facing a human being on his path to the stars. But at present I want to tell you about something else.

"Just before the day of the flight, I went to Moscow. And all the way back to the cosmodrome I remembered the excitement which had gripped me when I was standing near the Lenin Mausoleum.

"I walked slowly along the Kremlin walls on the bank of the river, then crossed the Red Square to the chime of the bells of the Spaskii Tower. I stopped near the Mausoleum, with a hand raised in salute, saw how the guard was changed and slowly wandered along Moscow's streets. Though all around me was the noise of the city, I could feel the first promise of spring. That same night I flew out to the cosmodrome...

"And it all happened on April 12, the day the spaceship 'Vostok' took me into the vastness of space..."

"Here's another bit.

"After the celebrations on my return I had a desire to visit the Lenin Mausoleum. As I went down the granite steps I could feel my heat beating. And there in the sarcophagus, illuminated by soft light, lay dear 'Il'ich'. I stood reverently looking at the dear features of the great man, the founder of the Communist Party and the Soviet State."

Gagarin finished reading. For a full minute complete silence reigned in the room. It was broken by our host.

"When I was still in school I became acquainted with the Red Square for the first time without actually having seen it. I had a passion to collect picture postcards of Moscow. The collection was a big one. I traveled through the capital by looking at the cards and could name every place shown on the photos. Eventually I came to the Red Square when I wanted to get admitted to the Industrial Training School. And later I flew in from the north for my selection to the detachment of astronauts."

"Yurii Alekseevich! Your article must start with this."

Gagarin became thoughtful for some time and started turning over the written pages.

"I will do that. Thanks for the kind advice. Well, we are quits. I helped you, and you helped me. Maybe I will tell you about one of the other boys. However, let's call it a day. Otherwise you won't want to come a second time", cracked the astronaut.

To anticipate events, we may say that Yurii Gagarin's article entitled "Unforgettable" formed a part of the collection "Our Main Square". And its first words were, "I want to begin not with April 14, 1961, when Moscow's Red Square welcomed me after the space flight, but with my school years..."

Yurii Alekseevich rang up an acquaintance in Moscow, asking him to help his sister in buying a ticket for Gzhatsk.

When we parted, Yurii Alekseevich asked, "You have a car. Please take Zoya with you, she is leaving for Gzhatsk."

From the "Star City" we brought with us a present, a voluminous book "Morning of the Space Era" about the flight of Yurii Gagarin and German Titov. On the title-page was written "In memory of this era and your labor connected with it. With regards, Gagarin."

The road to Moscow seemed to be very short. Our dear traveling-companion Zoya Alekseevna told us many interesting things: how attentive and solicitous Yurii Alekseevich was towards his parents and toward all his relations and what sort of a person Yura was during his childhood and youth.

Here is just one episode from Yura's childhood. Once, just before the Nazi invasion, a Soviet fighter was shot down near Yura's village. Another plane also landed. The pilots decided to burn the unrepairable plane and fly away in the other one. By the time they had transferred the gasolene, Yura ran home and brought bread, lard, and an earthenware jug of milk. The pilots thanked him for the refreshments, but did not take the lard, saying that it would come in handy for their hosts. They asked the boy his name and surname.

Many years passed. After Gagarin's flight into space, one of the pilots sent a letter narrating this episode. His comrade had laid down his life for the motherland during the war...

* * *

To be useful to the people! This is what the astronaut first explorer of space, Yurii Gagarin strived for. Academician Sergei Pavlovich Korolev, communist, scientist, and teacher of Soviet astronauts, served as an example for him. Yurii Alekseevich always remembered these words of his teacher, "Love your land and the people who brought you up."

Yurii Alekseevich nourished a deep feeling of filial love and respect for the man who created the rocket-space system which lifted him and other astronauts into the unexplored distances. Several entries preserved in our notebooks testify to the friendship of Gagarin and Korolev.

The 23rd Party Congress was held in the Kremlin Palace of Congresses at the end of March, 1966.

A team of TASS was covering the work of the Congress for the Soviet and foreign press. During the session we were charged with one more mission. We had to get captions for the rare photos in which Academician S.P. Korolev and Yu.A. Gagarin stood together.

Gagarin was sitting in the Presidium. We had to send the envelope with two photos up there. In a note, we asked him to answer the question, when and where the pictures were taken. We also asked him to write a few

S. P. Korolev (right) and Yu. A. Gagarin
May 1961.

sentences about the role of S.P. Korolev in the development of astronautics.

We were putting our notes in order in the press box during the recess when Gagarin came in.

"I have written down everything," he said, and sat down by our side, "Hold it."

On the back of the photos was written, "These pictures were taken in Sochi, during a vacation in May 1961. Gagarin."

"But what about the most important thing?"

"Here."

In the left corner of our note there were just three lines, "I think it is blasphemy to write *a few words* about such a man. Our attitude toward him is known to everyone."

There was a pause.

"Are you offended?"

"Oh no..."

"I got the pictures and thought: how quickly time flies. How much has been done during these five years... And you want a few words about Sergei Pavlovich," the astronaut continued, stressing the word 'few'. A shadow floated over Gagarin's face, "For the first time we will be celebrating the Day of Astronautics without him... He had a warm heart and intellect, which was capable of comprehending a lot and could foresee a lot. Now he would have been with us at the party congress.

Keeping quiet for some time after all these reminiscences, Gagarin uttered dreamily:

"Today at the Congress we are nine astronaut-communists. But after one year, after two, after ten? And who knows, some time after many many years, they will have their own regular party congress. Then, delegates from the Moon, Mars and Venus, would be sitting here..."

"You are letting your imagination run, Yurii Alekseevich."

"But why not? At first fantasy, but later... the reality." Yurii Alekseevich threw a glance at Korolev's photograph, "Sergei Pavlovich loved to let his imagination run, loved to dream. He told us, how he studied in the evening University of Marxism-Leninism, in spite of his being so busy. He knew the works of Lenin well and many times quoted to us his words that there never was, is, nor can be, any human search for truth without human emotions."

"Tell us about your first meeting with Sergei Pavlovich..."

After uttering the words "Read the 'Path to Space,' page 105", he threw his head back slightly and started laughing infectiously.

We quoted... "We saw a broad shouldered, cheerful, witty man, a real Russian with a good Russian surname and patronymic..."

"Something is due from me," the astronaut gave in.

"Exactly. However, not very much. Not more than what we asked you to write on this photo. Don't take offence, Yurii Alekseevich."

"Oh no," answered the astronaut throwing our own words back at us. "Honestly, I want to write a big article about Sergei Pavlovich. Maybe we will write it together with the boys. If you want to know, some things are already there. Then, at the time of the condolence meeting in the Red Square, I was asked to speak the parting words about our teacher. Whatever I said then are the thoughts and feelings of all pilot-astronauts. Sergei Pavlovich literally led us by the hand into outer space."

"Tell us, Yurii Alekseevich, about your most memorable meeting with him."

"Near the craft 'Vostok'," Gagarin answered quickly, "On top of the launch rocket."

The astronaut described how he went up to the "Vostok" together with Sergei Pavlovich just before the launching... They stood on the platform for a long time without a word, each engrossed in his own thoughts. The steppe was deserted. The towers of the high-voltage lines were standing in rows like giants. Snowy white clouds were floating in the sky.

The silence was broken by Sergei Pavlovich.

"Our earth is most probably very beautiful from the heights," and turning to Gagarin he smiled. "Lucky chap! you will see it from such a height... The launch and the flight will not be an easy one, Yurii Alekseevich. You will have to experience high gravity forces as well as weightlessness and

maybe something else, of which we are not aware. We have talked about it a number of times, but all the same I want to remind you that tomorrow's flight involves an element of risk. This is not new for you either." The scientist put his hands on the astronaut's shoulders and kept quiet for a long time. Then changing over to "thou" he said, like a father, "Yura, everything is possible. But remember, whatever may happen, all the power of thy reason will at once be at thy service."

Sergei Pavlovich took a deep breath and looked into the distance for a long time, bending his massive head to one side by force of habit. Then he gave a broad smile.

"Everything will be O.K.! I am absolutely certain about the success."

Yurii Gagarin ended his account of the memorable meeting with the scientist before the flight. We asked him to tell us about his meeting with S.P. Korolev after the flight. But the bell, recalling the delegates to their seats, started ringing.

"During the next recess! We shall continue there down below, in the Presidium room near the entrance," said Yurii Alekseevich, having already started moving.

Unfortunately, the conversation could not be continued on that day, nor later. Instead, some foreign delegation caught hold of the astronaut during the recesses.

A few days afterwards, on April 12, Yurii Alekseevich addressed the grand rally, dedicated to Astronautics Day:

"Dear friends, how very sad that the man who dedicated so much of his strength, health and energy to the penetration of space is not with us today. The remarkable scientist-designer, Sergei Pavlovich Korolev, whom we all loved so much, is not among us. The person who created our national jet propulsion and space technology is no more. Sergei Pavlovich both saw us off into outer space and received us back on our return to the earth. Setting an example with his own life he forced us to study continuously."

It seemed to us that when Yurii Alekseevich spoke about his teacher, he threw a glance at the rows where Academician Korolev used to sit, "forgetting" to pin the two Gold Stars of Hero of Socialist Labor and the decoration of Lenin Prize Laureate on his dark suit.

It so happened that the next prolonged discussion with Gagarin also took place at this very place, in the Palace of Congresses, but it did not take place until November 1964, when the 50th anniversary of the Soviet Union was being celebrated. Representatives of over 80 countries, fighters for a better future for mankind, were present at the ceremonial gathering.

"As always, I have no time to spare," observed Yurii Gagarin during one of the breaks. He was sitting in an easy chair far from the noisy corridors of the palace. "In a few months I have to defend my graduation thesis. I am writing a book in coauthorship with a doctor-psychologist. You must

know him—Vladimir Lebedev."

"What's the topic of the book?"

Yurii Alekseevich said the book was called "Psychology and Outer Space" and from it readers would come to know what composite training has to be undergone by pilots before space flights, about the responsibility that falls on their shoulders, not only as the commanders of the craft, but also as investigators and themselves as objects of investigation.

Imperceptibly we drifted to "space" literature and to the scientific articles of Academician Korolev, which were published at various times in newspapers and journals.

"Their number is not small," Gagarin said. "It would be nice to publish them as a separate collection. I have kept the cuttings with care. Sometime back I re-read them. They are clear and to the point, with the tone of a publicist and also full of romance. They gave me such an impetus! Their value apart from the program of future investigations, lies in their clear-cut, consistent enumeration of the core problems."

"Yurii Alekseevich, you promised to talk about the most significant conversation with Korolev after your flight."

"Promised! You remember the photo under which I wrote at that time. It was taken soon after the memorable conversation. During those days in May 1961—only one thought, one question was dogging me all the time —'What next?' " I knew the approximate program of the flights. Knew that my comrades were getting ready, dying to go into space. How would I engage myself? I decided to take Sergei Pavlovich's advice. We were sitting in the garden, near the house. "And what should I do next?" I asked the scientist.

"And what do you yourself think?"

"When one is a pilot everything is clear. Today a sortie, tomorrow a sortie, and so on every day. Work!"

"I understand. But this is only a statement of fact," concluded Sergei Pavlovich. "Where is your proposal?"

"To fly into outer space once more," I said, hesitatingly.

"I agree, but only with a task more difficult than the first one. Time and knowledge will be required."

"I have to study. Have I understood you correctly?"

"Zhukovskii Academy," continued Sergei Pavlovich. "I myself dreamed of joining it during my youth. You know very well how extensive is the knowledge of your comrades who have finished the Academy."

* * *

. . . Life continues its course. The youngest of Gagarin's daughters, Galya, went to first standard in the fall of 1968. Yurii Alekseevich always came to

the "Star City" school on September 1. This time he was not there. Yurii's friend Aleksei Leonov congratulated the children instead.

When Gagarin's eldest daughter Lena started her school life, her father shot her on a movie film as a remembrance of that day. At Valentina Ivanovna's request the film about Galya, the first standard girl, was shot by Valerii Bykovskii.

On the evening before the start of the academic year, Valentina Ivanovna showed her daughter the book meant for first standard students called "A Little Star."

"Read it. This was written by your papa when you didn't know how to read. It was written for little tots like you..."

And Galya read:

"My dear friend. Congratulations! Now you also have become quite big, now you have also become a school-going child. Important, difficult problems face you: to learn, to read, write and count. All the people on this earth, pilots and sailors, workers and scholars, collective farmers and artists, started their studies with a line similar to the one in your exercise book, with the first alphabet on the blackboard, with the first word in the ABC book. In school you will not only become an educated person, but will also learn to make friends. The teachers, 'Pioneers' and Octoberite 'Little Stars' (which has the important rule: 'Octoberites are friendly lads') will help you to be sympathetic. Then the class will not be simply a class, but a collective. A collective can achieve a lot. In a collective all are worried about the common cause and take care for one another, One for all and all for one. The Soviet people have such a good rule.

"Dear friend! I wish you happiness, good health and success in study. Your friend, Yurii Gagarin."

...This has remained, forever dedicated to children.

A note on the leaf of the calendar for March 27, 1968 is also left, which states the work Yurii Alekseevich had to do that day:

"(1) 1000—Training flights.

(2) 1700—Editorial office of the journal "Ogonek". Have to speak at the "Round Table".

(3) 1900—Meeting with foreign delegations: Central Committee of the Leninist Young Communist League of the Soviet Union."

The sheets with the speech for the commemorative meeting of the A.M. Gorkii Centenary remain unread.

"...The indestructible spirit of Gorkii's 'stormy-petrel', of Gorkii himself and faith in their victory, lives in the soul of every one of my comrade-astronauts, in the soul of every one of those Soviet people who helps send us up into space. Enchanted by the first successes of socialistic construction in the country of the Soviets, Gorkii even at that time predicted, 'People will even reach Mars'..."

At a new year party.

Gagarin lives in our hearts and in the people's memory. We remember him in that form in which we loved him, in which we were accustomed to see him... Wherever Yurii Alekseevich appeared, he shed an atmosphere of exceptional warmth and affection. He had the knack of speaking in a simple yet figurative and attractive manner. When the astronaut addressed a rally of young construction workers from Siberia and the Soviet Far East in Krasnoyarsk, he was met with an ovation. The youth of Murmansk region, the inhabitants of Komsomol'sk-on-Amur and many other cities, participants of various congresses, meetings and rallies warmly applauded him. His voice resounded in the Red Square, in the Columnar Hall of the House of Unions and in the Kremlin Palace of Congresses...

Workers elected him an honorary member of their teams as a token of their respect. We have on record the decision of the general meeting of the Complex Team of Communist Labor taken after the hero's death. This Team has now been named after Yu.A. Gagarin.

"In view of the services of the world's first astronaut, Hero of the Soviet Union, Yurii Alekseevich Gagarin to the motherland, to the Communist Party of the Soviet Union and to the Leninist Young Communist League of the Soviet Union, remembering that Yurii Alekseevich Gagarin participated in laying the first cubic meter of concrete in the power house part of the dam of the Krasnoyarsk Hydroelectric Station, the meeting decrees:

To request the Chief of the Construction Directorate and the Joint Erection Committee of Krasnoyarsk Hydel Construction to include Gagarin's name in the list of honorary constructors of Krasnoyarsk Hydroelectric Station along with an entry in the book of honor for the construction and the subsequent inclusion of his name on the memorial plaque of the veteran-constructors.

On behalf of the meeting Soviet of the team: Pozdnyakov V.A., Reshetnikov A.N., Kornienko A., Goncharov C., Mel'nikov B."

In such ways is immortality bestowed.

Gagarin will continue to live on in the new space voyages. He was an example for his comrades both in study and work. Yurii Alekseevich was present at the launching of all the spacecraft. He gave instructions and admonished those who went on a flight. When the automatic system on "Voskhod-2" stopped functioning, Pavel Belyaev heard the calm voice of his senior comrade, giving the order to change over to manual control. Pavel Ivanovich told us later that this calmness had had an enormous effect on him and Leonov, and had inspired faith in their success, which they were to achieve.

It is already a tradition for all astronauts to visit Gagarin's study in the 'Star City' before going to the cosmodrome. Gagarin's successors on the space tracks, V. Shatalov, V. Gorbatko, V. Kubasov, A. Filipchenko, A. Eliseev, V. Volkov and G. Shonin wrote in the visitors' book:

"Love for this remarkable and cheerful man Yurii Gagarin is carefully preserved in our hearts. He entered our lives as a man of kind and beautiful soul, strong will and great modesty."

How many flights are still ahead! And of what kind! Yurii Alekseevich dreamed about them all. They will be realized by his friends and successors.

Taking stock of all that had been achieved during the decade after the launching of the first artificial satellite from the earth, Gagarin stressed.

"The first satellite, the first automatic station for the exploration of the moon, the first interplanetary flight and the first manned flight, these are glorious landmarks in the first years of the space era; and the Soviet people, who are building communism, have placed them on the main highway of history."

The path into space is full of unexplored things. Literally every step may be full of difficulties. Our astronauts understand this very well. The indispensable elements for success in future space flights are: sound knowledge, complete mastery of the latest space technology and excellent physical training.

"...When the carrier rockets took the spacecraft out into orbit, we the astronauts, always felt the support of the whole Soviet nation. We were proud of the faith put in us by the motherland and its noble deeds illuminated the path ahead of us with the light of immortal Leninist ideas."

Gagarin was proud of the faith the motherland had in him, and our country will always be proud of its talented son.

THE "VOSTOK" DESIGN

THE spacecraft-satellite "Vostok" is a single-seat rocket-flown apparatus, intended for scientific and technical research programs and experiments in satellite orbits around the earth. Yurii Alekseevich Gagarin made the world's first flight in space in such a craft on April 12, 1961. For putting the craft into a near-earth orbit, the multistage launch rocket "Vostok" was used.

The "Vostok" space rocket system was created between 1958 and 1961 under the guidance of the chief designer, Academician S.P. Korolev.

The "Vostok" spacecraft consists of the recovery capsule, which is at the same time the astronaut's cabin, and an instrument bay. The craft weighs approximately 4730 kilograms. Together with the final stage of the carrier rocket, the craft weighs about 6170 kilograms. Their total length is 7.35 meters. The flight of the "Vostok" can be controlled both automatically by orders from the earth, and manually by the astronaut himself.

Outer space, in which the spacecraft-satellite flies, is characterized by

extremely low barometric pressure, absence of the usual oxygen-carrying medium, sharp variations in temperature and cosmic and ultraviolet radiations (dangerous for living organisms) as well as the presence of meteorites in the airless medium. The sealed cabin design of the recovery capsule, equipped with a life-saving system, protects human being from the unfavorable conditions of outer space. This also creates and maintains the microclimate in the craft which is essential for the life and activities of a human being. The spacesuit serves as another means of protection.

We can describe in detail the cabin of the spacecraft, the so-called recovery capsule. It is made in the shape of a ball with a diameter of 2.3 meters, and weighs 2400 kilograms, of which the instruments weigh 800 kilograms... There are two fast-opening hatches—the parachute hatch and the entry hatch, three portholes with heat-resistant glass panes, which allow the pilot to make the necessary scientific observations during the flight. The astronaut takes his place in the ejection seat, which helps him to endure the high gravity forces created during takeoff and landing. The seat is a very complex technical installation. A detachable back with strap system, parachute system, ejection cartridge, oxygen supply and pressurized suit ventilation system, automatic instruments of the seat and survival pack (that may be needed after landing—containing food, water, radio receiver and transmitter, signal rockets, pneumatic dinghy and outfit), all these features are incorporated in the seat.

There is a porthole right in front of the astronaut with the optical device "Vzor". It is meant for the orientation of the craft at the time of manual control on the flight. A television camera, an instrument panel with indicators and a signal board are above the porthole. Also a clock and a small globe, which allows the astronaut to pinpoint the places on the earth's surface over which he is flying at that particular time. This device is also essential to select the moment for firing the retrorocket engine at the time of manual control for landing in a given region.

The pilot's control panel is situated to the left of the astronaut. It has levers and switches for controlling the radiotelephone system, temperature regulation in the cabin, as well as for switching on the systems of manual controls and retrorocket firing. A container with spacecraft parachutes, reserves of drinking water, emergency system of thermoregulation, radio direction finder and tape recorder are also placed in this part of the spacecraft.

The levers for manual control of the craft, food containers, regeneration and airconditioning system, electrical clocks, television camera, radio receiving set, blocks of storage batteries, and the human waste removal system are situated on the right of the cabin.

The system of regeneration and airconditioning creates and maintains the essential gas composition of the air and humidity, normal pressure (about 750 millimeters of mercury) and temperature (within the range of 15–25°C).

The reserves of food, water and materials for the regeneration of air and the sources of electrical energy in the "Vostok" are intended for a ten-day operation. Fixed on the outside surface of the craft are, solar sensor orientation cells with reserves of pressure, gas bottles, heat-radiator, oxygen and air bottles for the astronaut's breathing and the ventilation of the spacesuit (in case of the depressurization of the recovery capsule).

The instrument bay occupies a considerable portion of the craft. The retrorocket, sources of electrical energy apparatus for control systems, television, communications, regulation of cabin temperature, radio apparatus for measuring the parameters of the satellite's orbit and radio telemetric instruments for sending the checkup information to the earth are situated in this compartment. The specialists in different branches of knowledge are deeply interested in the checkup information. Thanks to this, it was possible to find out about the physiological indices of the astronaut (with the help of electrocardiogram, pneumatogram, seismo-cardiogram, etc.), the parameters of the microclimate in the cabin (temperature, pressure, humidity and composition of air), data about the functioning of the systems on board and data about the level of cosmic radiation in the cabin.

The rate of the astronaut's pulse and breathing is controlled through a special channel of the radio transmitter signal. The doctors make judgements about his condition according to the information provided by radio conversations and television pictures.

The astronaut maintains two-way radio communication with the earth at the time of space travel with the help of a radiotelephone system working in the range of short and ultrashort wavelengths, or with the help of radiotelegraph.

"Vostok" spacecraft flew in orbits at the height of—in apogee, 222–327, and in perigee, 175–183, kilometers. The inclination of the orbits to the plane of the equator was 65 degrees. The craft completed an orbit around the earth in approximately 88 minutes.

Even if the retrorocket did not fire, the "Vostok" would enter the thick layers of the atmosphere in the course of ten days, because of the natural braking in the upper layers of the atmosphere, and could be brought down with the help of the landing system.

Before the craft leaves its orbit ready for landing, it chooses the specific spot on the automatic system of orientation, using the cells and solar sensor, and brings the axis of the engine in line with reference to the sun and maintains this orientation in space as long as the engine is working. (Astronauts may use the manual control system for the orientation of the craft). The speed of the craft is reduced and it changes over to the trajectory of ballistic re-entry as a result of the retrorocket's action. Then the separation of the craft takes place: during the further movement toward the earth the instrument bay is destroyed in the thicker layers of the atmosphere, but owing to its

heat-resistance, the recovery capsule passes through the thicker layers of the atmosphere without fear of burning up in the 10,000 degree temperature around it. During this period of the flight the temperature in the astronaut's cabin is normal. But the human organism has to suffer about eight times the normal gravitational forces.

The landing system of the "Vostok" provides both for landing on the earth with the recovery capsule, as well as without it. In the latter case, the cover of the entrance hatch is automatically jettisoned at the height of seven kilometers and the astronaut is ejected. After this the parachute system starts its work. At the height of four kilometers the seat is separated, and the astronaut along with the survival pack continues his descent by parachute. The parachute of the recovey capsule's landing system also opens at the height of four kilometers.

The astronaut's speed of landing is about six meters per second. In case he lands on water, he can use the automatic dinghy which constitutes a part of the survival pack. With the help of dinghy and parachute a cosy shelter can be erected against wind and cold.

THE SPACESUIT

As is well known, "Vostok" astronauts worked in special spacesuits intended for safeguarding the life and working capacity of the pilot from the destructive effects of outer space conditions. The space dress allows the pilot to isolate himself from the atmosphere of the cabin in cases of depressurization or on the appearance of harmful admixtures. The spacesuit consists of overalls, helmet and gloves. The first of the three external covers is made of dacron, with a system of ropes and hinges for fitting the suit according to the astronaut's height. The second is a thin elastic rubber suit which maintains the pressure, then another one for heat isolation with a system for ventilation. On top of the pressure suit, a suit of orange overalls is worn.

The helmet of the spacesuit has a transparent visor, which can be raised. The ventilation of the pressure suit is carried on by the cabin air with the help of ventilators at the time of normal conditions of flight. If the pressure or the gas composition of the cabin rises above the permissible limits, the helmet automatically closes down and a system of emergency ventilation is switched on. In this case air is pumped into the pressure suit from the bottles, while a gas mixture enriched with oxygen, or pure oxygen is pumped into the helmet, depending on the pressure in the cabin. The required pressure in the spacesuit is maintained with the help of regulators.

If the astronaut comes down on water, the spacesuit can support him on the water, provided he lies on his back. It is possible for a human being to continue living in cold water (with a temperature of 0°C) for

twelve hours because of the pressure and heat isolation of the spacesuit.

IN SPACE : MANY STAGES

The spacecraft "Vostok" entered into orbit around the earth... What miraculous force raised it to such an enormous height? A space rocket. By giving the necessary velocity, it threw an almost five ton craft into orbit.

The creation of a three-stage launch rocket "Vostok" in 1958–60 was the most important achievement of Soviet and world rocket construction. In capacity it was considerably superior to all the earlier launch rockets.

The total length of the launch rocket "Vostok's" six blocks is 38 meters. The maximum diameter at the stabilizers (placed at the base of the rocket) is 10.3 meters. The length of the central block is 28 meters and its maximum diameter 2.95 meters. The length of the side block is 19 meters and diameter 3 meters. The length of the third stage together with the nose fairing is 10 meters and diameter 2.58 meters. The six liquid propellant engines of the launch rocket develop a total maximum thrust of 600 tons and total useful power in flight equal to 20 million horsepower. Many artificial satellites, automatic stations and the manned spacecrafts "Voskhod" and "Soyuz" were successfully launched with launch rockets having similar engines.

The launch rocket and the spacecraft, built at separate factories, are assembled in one complex at the cosmodrome and are thoroughly re-tested.

When the preparation for launching the rocket is complete, the tanks are filled with fuel, the apparatus on board is switched on and the astronaut takes his place in the cabin. Then the main control panel gives the command to fire the engines. The device for switching on the central and side engines starts functioning. When they reach the condition of preliminary thrust, the turbine pump assemblies start working. The pressure of the fuel components at the time of entering the combustion chamber rises, and the engines reach the condition of full thrust. At the moment when the total thrust of the central and side block engines becomes more than the combined weight of the launch rocket with spacecraft, the rocket starts rising.

At first the rocket rises vertically. This permits it to cross the thick layers of the atmosphere by the shortest route. At a stipulated height, the control system starts spinning the rocket in a vertical plane with the help of steering cells and stabilizers. This is done, so that at the end of the engines' last stage, the velocity of the spacecraft would be in a horizontal direction. When the fuel in the side tanks burns up, the side blocks are automatically disengaged from the central block, whose engine continues working with full thrust. The nose fairing, which protects the craft from the heavy aerodynamic and heat loads, is thrown off beyond the thick layers of the atmosphere.

The engine of the third stage of the rocket is switched on and the central block detaches itself at the next stage. As soon as the calculated speed of about eight kilometers per second is reached, the control system gives the command to switch off the engine of the third stage, and later on commands the stage's detachment from the craft. The orbital flight starts.

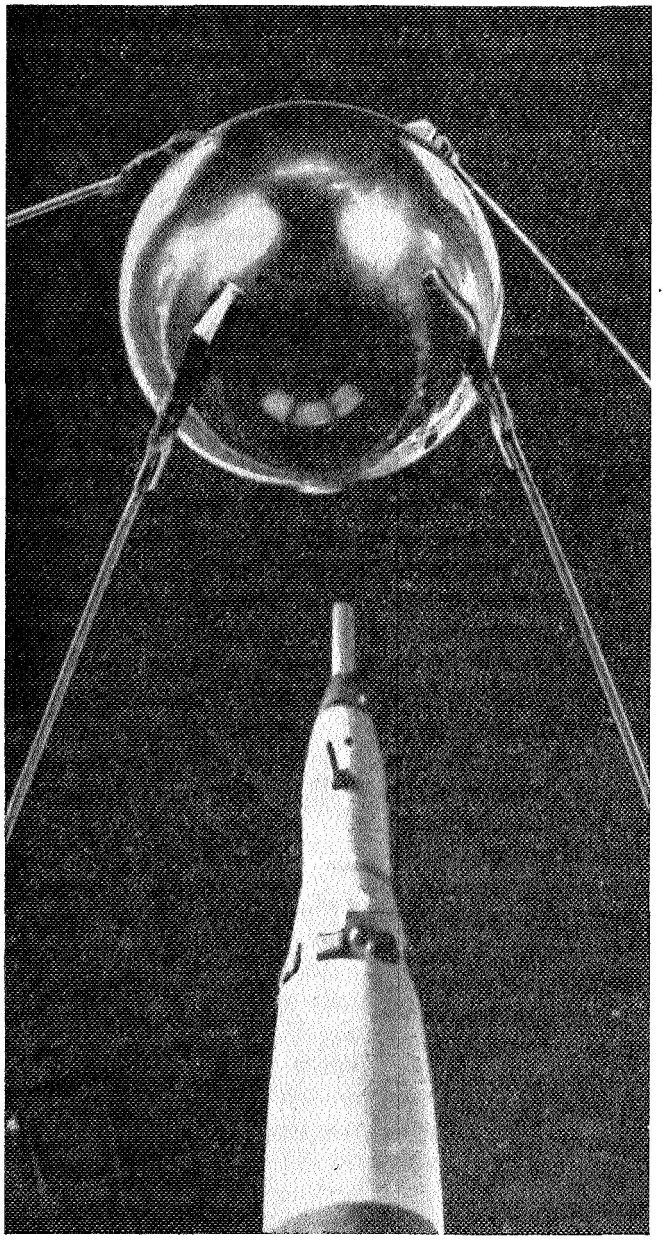
ALL THIS STARTED LONG AGO...

The first flight of man in space was preceded by innumerable experiments carried out in high altitude geophysical rockets and satellite craft with different biological objects on board. They had already started in 1951, much before the start of the space era. This began in October 1957 with the Soviet artificial earth satellite.

Animals—dogs, rabbits, rats and mice—were put in the pressurized section of the front part of the rocket, in which special life-protection systems maintained the normal barometric pressure and gas composition essential for breathing. The rocket went up to a height of 100 kilometers and then the front section separated. It first fell to a height of six kilometers along with its "passengers", and then came down to earth with the help of a parachute. The duration of the flight of the animals from the time of firing the rocket was 20–30 minutes. Their main physiological functions, functioning of the heart, breathing, blood pressure, etc. were registered. The parameters of the microclimate in the cabin were also fixed. The problems of safety, capacity to survive and vital activity of the animals in the pressurized cabin at the time of the rocket's flight in the upper layers of the atmosphere were solved as a result of these experiments. The high gravity forces, partial weightlessness, vibrations, cosmic rays and other factors arising at the time of the flight, did not cause any change either in the animals' behavior, or in the condition of their organisms.

The aim of subsequent experiments was to work out the methods of ensuring the safety of the animals in depressurized cabins, the creation of the essential conditions at the time of ejection, free fall and descent by parachute from great heights. These experiments established the essential conditions for maintaining the life of animals: up to a height of 110 kilometers in a depressurized cabin with ejection from the cabin and descent from the height of 75–86 kilometers and with a total flight time of 50–65 minutes. These can be created with a pressure suit having an oxygen supply system. A parachute system ensured the safe descent of the animals and apparatuses from a height of 75–86 kilometers.

In 1955, scientists started experiments with animals sent to the height of 212 and 450 kilometers in a pressurized cabin. The pulse, blood pressure and breathing of the dogs was registered, and their electrocardiograms were taken. Continuous movie-films were also taken.



The world's first artificial earth satellite.

The main physical factors which had an effect on the animal organism, were high gravitational forces (maximum six times) and weightlessness (duration of 6–9 minutes). The metallic walls of the cabin protected the animals from the action of solar radiation. The short duration of the flights did not give the opportunity to study the effect of cosmic radiation on the living organism.

As a result of several experiments, the inference was drawn that gravity forces arising at the time of the rocket's ascent and again as a result of the braking of the cabin in the atmosphere at the time of descent, have the maximum influence on the dog's organism.

In spite of the valuable and important results achieved, it was clear that these were only the first steps. One of the deficiencies of the experiments was the short duration of the flights. It was not possible to make any conclusions regarding the influence of weightlessness and cosmic radiation. A prolonged orbital flight was needed to solve such questions. On board the second Soviet artificial earth satellite launched on November 3, 1957, was the dog *Laika*: the first living being to perform an orbital flight in the world.

According to the design, the satellite was the last stage of a launch rocket. Located on it was a special pressurized cabin, a spherical container with apparatus and radio transmitters and scientific instruments for studying the sun's radiation and cosmic rays. Normal conditions for the existence of the animal were maintained in the cabin with an airconditioning system; food was stocked in the form of an iron colored mixture, which contained the main food substances and water. A number of instruments kept track of the animal's condition, took cardiograms, registered the pulse and breathing rate and measured the temperature and air-pressure in the cabin. A special radiotelemetry system transmitted all the data to the earth.

Laika reacted very well to the prolonged effects of high gravity forces at the time of the satellite's launching into orbit and to the subsequent condition of weightlessness. The experiment, carried out at the heights of 225–1,671 kilometers, proved the possibility of a prolonged stay under conditions of weightlessness by a highly disciplined animal without apparent violation to the functions of the most important systems of the organism.

The launching of spacecraft-satellites aimed at experimental verification and mastery of design and systems of flying apparatus, intended for the flight of man in near-earth space, started in the Soviet Union in May, 1960. The development of devices, which returned to the earth, made it possible for scientists to proceed to the realization of the final stage of medico-biological experiments connected with the preparation of man's flight in space.

Study of the peculiarities of the vital activities of animal and plant organisms and investigation of the biological effect of the main factors of space flight on living organisms were included in the program of medico-

biological experiments of the second spacecraft-satellite, which went into orbit on August 19, 1960.

Two dogs—*Belka* and *Strelka,* 40 mice, two white rats, insects, plants, mushrooms, seeds of corn, wheat, gram and onion, some types of microbes and other biological objects were placed in the cabin of the spacecraft. This permitted sufficiently detailed study of the effect of flight factors on very varied processes and functions of organisms.

The scientific instruments placed aboard the spacecraft-satellite investigated light and heavy nuclei in the initial space radiation, and X-ray and ultraviolet radiation of the sun and registered the level of cosmic radiation in the cabin.

The second spacecraft-satellite flew at the heights of 306–339 kilometers and the flight continued for over 25 hours. The spacecraft left the orbit and landed at the predetermined spot at a command from the earth while on its 18th circuit. For the first time in history living beings had returned safely to earth after an orbital flight. The experiment gave exceptionally important data about the influence of space flight factors on the physiological, genetic and cytological systems of living organisms.

The main indices of the cardio-vascular system, the breathing organs, alimentary canal and the general behavior of the dogs under examination, registered during the whole period of the flight, did not go beyond the normal ranges.

The experiment showed that if there are no solar flares, the dose of radiation inside the cabin of the spacecraft is not great. It is much lower than the maximum permissible dose and is due mainly to the initial cosmic radiation and is not dangerous for future astronauts.

The flight of the spacecraft-satellite proved the reliability of all its systems, including the lifesaving, descent and landing systems. Scientists drew the inference on the possibility of man's flight, without causing any harm to his health, in an orbit passing below the radiation belt of the earth. The successful launching of the fourth and fifth spacecraft-satellites with animals on board indicated that the preparatory stage of man's flight into space had come to an end.

YURII GAGARIN IN SPACE

The world's first spacecraft, the "Vostok" manned by pilot-astronaut Yurii Gagarin, started on April 12, 1961 at 0907 hours, Moscow time. The firing of the launch rocket was successful. "Vostok" started its flight along a near-earth orbit at the heights of 181–327 kilometers.

At the time of launching Gagarin maintained radio communication with the flight control center, observed the light signaling on the instrument panel, controlled the separation of the rocket stages and of the spacecraft from the

last stage. The astronaut bore satisfactorily the effect of high gravity forces and vibration during the climb of the rocket.

As soon as "Vostok" started orbital flight, the condition of weightlessness obtained. For the first time a man experienced this unusual sensation for a prolonged period. But Gagarin felt quite well.

The work of the apparatus on board the spacecraft during the first flight of man in space was controlled by automatic machines. The astronaut controlled the work of the spacecraft systems with the help of instruments and indicators, maintained telephonic and telegraphic radio communications with the station on earth and observed the earth's surface through the portholes.

During the flight Gagarin took food, packed in tubes, and drank water.

After orbiting the earth at 1025 hours, the retrorocket was automatically switched on and the spacecraft started its descent.

Through the blinds covering the portholes, Gagarin saw the flickering of flames raging round the spacecraft. Weightlessness disappeared smoothly but the growing high gravity force clasped the astronaut to his seat. It increased and acted more tangibly than at the time of ascent. Then, after the speed of the machine reduced, the parachute opened at a height of about four kilometers. The recovery capsule of the "Vostok", together with the astronaut, landed at 1055 hours near the village of Smelovka, in the Ternovsk district of Saratov region.

The duration of the flight from start to finish was 108 minutes. After returning from space Gagarin felt well.

The first flight in human history around the earth by astronaut Yurii Gagarin in the spacecraft "Vostok" led to a number of conclusions of enormous scientific importance about the practical possibility of man's flight into space. Man could bear the peculiarities of takeoff into orbit and also return normally to the earth's surface.

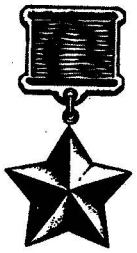
The flight of the "Vostok" proved the correctness of scientific and technical decisions, according to which the spacecraft was constructed, and bore witness to the skill of Soviet scientists, engineers, technicians and workers who had created a dependable rocket-space complex, which permitted the realization of man's flight in space. Also, the system worked out by Soviet doctors of selection, training and preparation of the astronauts for orbital flights stood the test.

German Stepanovich Titov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On August 6, 1961, in the Soviet Union, the spacecraft "Vostok-2" was launched into orbit as an earth satellite.

The spacecraft "Vostok-2" was manned by pilot-astronaut Air Force Major, German Stepanovich Titov.



"Vostok-2"

For making a distinguished flight in outer space in the satellite-spacecraft "Vostok-2", the title of the "Hero of the Soviet Union" with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Major German Stepanovich Titov.

* * *

For making a space flight in the satellite-spacecraft "Vostok-2" the title of the "Pilot-Astronaut of the USSR" is conferred upon Air Force Major, German Stepanovich Titov, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

German Stepanovich Titov was born in 1935 in the family of a secondary school teacher in the village of Verkhnee Zhilino in the Kosikhino District of Altai Territory.

He finished seven years' schooling in the village Polkovnikovo (Kosikhino District), and after that in Nalobikhinsk secondary school in the same district. In 1949 he joined the Leninist Young Communist League of the Soviet Union.

In 1957, he graduated from the Air Force Pilots' School with a first class, having taken the examination of flying technique "with distinction". After graduation Titov was sent to the Leningrad military district for service.

The Central Committee of the CPSU passed a resolution on August 7, 1961 to admit G.S. Titov, a candidate for membership of the CPSU, as a member of the Communist Party of the Soviet Union before the completion of his term as candidate.

The astronaut was awarded the Order of Lenin for participating in the preparation of the world's first flight of a man in space in the spacecraft-satellite "Vostok".

In February 1968, G.S. Titov graduated from the N.E. Zhukovskii Air Force Engineering Academy. He is also the President of the Central Steering Committee of the Soviet-Vietnam Friendship Society.

MIGHTY WINGS

THERE was plenty of time still left until 10 a.m.—the start of the air parade; but already the sectors of the airdrome had become crowded. All the time new spectators were arriving in cars and buses. The Domodedevo Airdrome was literally absorbing thousands of Muscovites every minute. They had come to see the program of the air show, dedicated to the 50th anniversary of the Great October Revolution.

Party and Soviet workers, social workers, marshals, generals and other senior officers had come to the guest-stands. The center of attraction was those people, whose birthday was being celebrated: the aviation pioneers and the representatives of the Air Force. Astronaut-2 German Titov had made himself comfortable. We sat by his side and started talking. A white cap with a long peak and dark glasses proved that German had properly prepared himself for the occasion. We had to pass several hours under the scorching rays of the sun, and the astronaut had decided to watch the flights of the latest supersonic aircraft with special attention. This interest was not accidental because German

Titov himself flew machines of new design. In fact he was himself a qualified test pilot.

A volley of artillery salutes thundered out, the national anthem of the Soviet Union was played. The beloved name of Lenin was traced in the sky by the YAK-18 planes.

An aerial procession led by helicopters carrying the State flag of the USSR and the ensigns of the Union Republics served as an original prelude to the main program. Girls in the national costumes of fraternal peoples were standing in cradles, hanging from the helicopters.

The applause broke out with renewed strength. In the azure sky another group of "metallic dragon-flies" appeared. Their pilots were entrusted with an unusual load. Everyone recognized the outlines of the first artificial earth-satellite, the spacecraft "Vostok", then the automatic station which carried out transmission by television from the moon for the first time, followed by the twelve-ton scientific laboratory "Proton-1"...

The people on the stands turned toward German Titov and his comrades and started cheering. In this very "Vostok" type he had assailed space in the footsteps of Yurii Gagarin. For the first time in history, Titov had established that man can live and work in space for more than twenty-four hours.

"And now pay attention" said Titov. "A plane is taking off from the airstrip."

At that very moment a red-winged supersonic fighter started its takeoff run. After attaining height the pilot, Likhachev, Hero of the Soviet Union, performed a cascade of aerobatics: 180 degree turns, vertical climbs, rolls, half rolls, vertical climbs and inverted flying.

Again from the airdrome, first a four-some and later seven supersonic fighters went up for a display. Astronaut-2 observed each group intently. He was fully acquainted with all the flying skills even before his space flight.

Next the helicopter experts demonstrated their skill; included was the spiral-winged giant "MI-6," which can raise a load of 25 tons, and the helicopter crane "MI-10".

German Titov waited impatiently for the latest models of Russian aircraft design to come on view.

Now that moment had come. First a plane with vertical takeoff and landing devices was demonstrated.

"Hero of the Soviet Union Colonel Mukhin is at work," announced one of the Air Force pilots, sitting nearby.

What an apt expression! Great meaning was contained in the word "work." The pilot sitting behind the controls really was working. Also those pilots worked who were flying the supersonic jet fighters with shortened takeoff run (it needed just two to three seconds before soaring into the

sky), and the aircraft with additional engines for vertical takeoff.

The announcer declared that a new machine was approaching the airdrome. The famous test pilot, Hero of the Soviet Union Colonel Vladimir Il'ushin would demonstrate its special features.

"My teacher!", said Titov. And meeting our enquiring glance, added, "He is teaching me to master my job as a test pilot."

Il'ushin dashed past at a low height, demonstrating his high speed, multipurpose fighter, while the vast concourse of spectators stood stock still with wonder.

"How beautiful! If only such a moment could remain" exclaimed the astronaut.

Yes, those seconds were beautiful, when the sleek fighter went tearing along right over our heads, a child not only of the designers, engineers and workers, but also of the test pilots, who signed its start in life.

"Excellent! Fabulous! Vladimir Il'ushin is a great master," Titov declared.

And we recalled the words of another distinguished test pilot, Georgii Mosolov, Hero of the Soviet Union, a world record holder.

"The demonstration of the maximum capacity of the machine depends on the machine itself, as well as on the pilot. It is quite understandable that no pilot, not even the very best, can achieve good results from a bad machine; similarly a mediocre pilot cannot utilize a good plane to the maximum capacity. Remember machines do not fly themselves. They are still piloted by men."

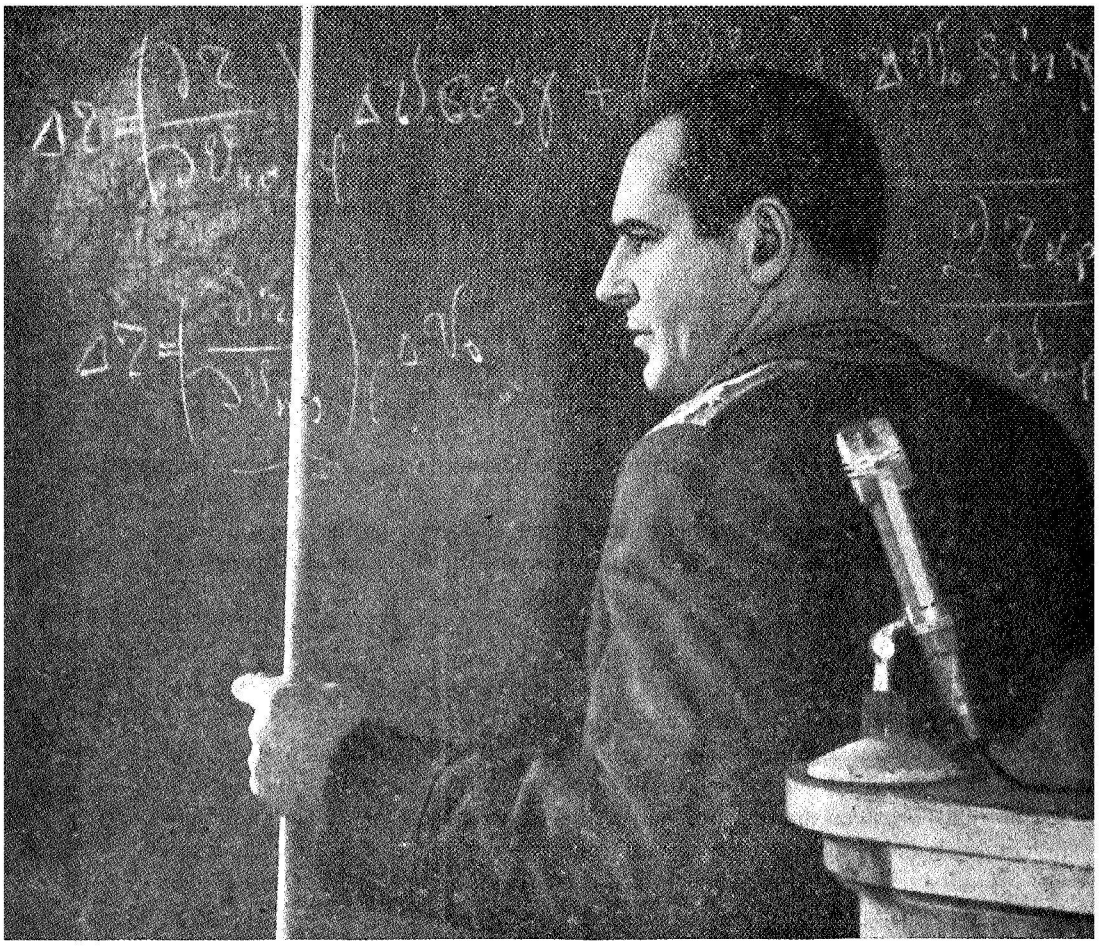
"Yes, the planes don't fly themselves yet, they are still piloted by men," repeated German Titov. "How many wonderful people I met in the Air Force. Well, there are not only test pilots, but also test navigators, test flight operators, test parachutists and the space outfit testers. Every one of us astronauts remembers Valerii Golovin with a kind word. It was he who tested the astronaut's costume and outfit and moreover it was done over the sea. He was commissioned to jump with new parachutes. Golovin also fulfilled the task connected with weightlessness."

Our conversation became animated. We felt that the problems peculiar to a tester's work deeply interested the astronaut. We asked him what was engaging his attention at present, and he replied.

"I fly a lot. I want to get acquainted with every type of aircraft, including the most modern. Tomorrow I am leaving for the cosmodrome."

"German Stepanovich! As a pilot, how many flying hours have you clocked?"

"In the logbook it is written that I sat in the cabins of various planes 800 times. This, of course, includes piston as well as jet planes. Naturally, the number is continually increasing because of my work as a test pilot..."



The science of winning... Astronaut-2 defends his diploma thesis.

The air parade and the parade of jet equipment continued. Up till now a supersonic plane with swinging wings during flight had never been demonstrated. It seemed at the start, that a conventional plane with wide wing span was standing. But after a short takeoff run and turn, in front of our eyes the plane folded in its wings like a bird, as if it was preparing for a jump, and increasing speed, disappeared in the heavens. Anticipating events we may state that the pilot, Hero of Soviet Union Aleksandr Fedotov answering the question as to what advantages such a plane offers, replied:

"It is rather a collection of planes in one machine: as if the pilot changed over to a new plane at the time of every change in the angle of the wings. Sitting in the pilot's cabin, he himself selects the aircraft needed by him at the given moment. At the time of takeoff he straightens out the wings, and at the time of supersonic speed he folds the wings in."

As Fedotov sped away from the airdrome in his "piloted rocket," German Titov could not stop himself from applauding. The speed was stunning...

Before this we had a long conversation with German Titov. The astronaut shared his thoughts about the path covered by our technology from the aircraft to the spacecraft and expressed his opinion about the prospect of rocket-planes.

"Aviation has gradually mastered heights and speeds," observed German Stepanovich. "The first planes went only a few meters above the earth, and the length of their flights could be measured in feet. To reach supersonic speed and intercontinental distances, half a century was needed. But the spacecraft during its very first flight broke all aviation records. It reached a speed of 28,000 kilometers per hour, and the minimum height of its flight was 180 kilometers.

"A sharp jump in speed, height and distance of flight was brought about. But the air space, lying between the heights 30–180 kilometers, remains still unconquered.

"I fly in supersonic planes of various types," continued German Stepanovich. "At times you go up to such heights that it seems as if you are on a space flight. The speed is good and the sky is the same dark blue as in space. But a moment comes when the aircraft becomes almost uncontrollable, the density of the atmosphere drops and the aerodynamic controls become ineffective. At this juncture one thinks: I would rather give a little more power to the engine and fly still higher. But an aircraft is not so very far away from the latter, and with every year the difference between the aircraft (I have in mind first of all the fighter) and the rocket diminishes.

"When you look at the takeoff of a rocket-carrier fighter, piercing the sky like an arrow, behold! it seems it will simply jump out into space and join the orbit like a spacecraft.

"But this looks simple only at first glance. To convert an aircraft into a rocket-plane, which would take off from an airport, carry out an orbital flight, and then land on the earth, is a complicated affair. For this it must combine the qualities of an aircraft with those of a spacecraft; that is, have the takeoff and landing characteristics of an aircraft and at the same time have the firmness and heat resistance of a space device. It is clear that the existing gap in the conquered heights and the fact that the spacecraft appeared before the space aircraft, are not accidental at all!"

German Stepanovich was lost in thought for a moment, then unexpectedly he asked:

"But is the space aircraft or rocket-plane needed at all?" He continued to himself, "The specialists of different countries, engaged in the conquest of space, have already long ago given an answer to this question in the affirmative. In the near future big orbital space stations answering various purposes: meteorological, astronomical and navigational will appear in

near-earth space. These will be permanently active bases, in which scientific workers and specialists of various profiles will be kept on shift duties. For furnishing them with all necessities and for the exchange of personnel, small flying devices will be required.

"The possibility of passenger and freight rocket-planes is not eliminated.

"Finally, new types of flying machines are needed if only for the fact that the higher reaches of the atmosphere cannot remain unconquered. It is not enough to pass through it at the time of the spacecraft's exit into orbit and descent to the earth. Controlled flight must take place in it. And when this happens, the apparent gap between aviation and astronautics will disappear without any traces.

"According to the prognosis of scientists of many countries, already in the near future quick development of winged space systems for repeated transport flights along the route earth — orbit station — earth, as well as piloted spacecraft with high aerodynamic qualities and high maneuverability at the time of flight in the atmosphere, can be expected.

"It is quite evident that the further progress of astronautics is unthinkable without its merging with aviation, with the accumulated experience of its specialists—pilots, designers, engineers, technicians..."

During that meeting we heard a lot of interesting things from Astronaut-2. And not only about aviation. German Stepanovich talked about Tsiolkovskii and the museum of the great scientist in Kaluga. He had been there several times...

The first time, German Titov went to Kaluga with his understudy Andriyan Nikolaev. The visitors' cars stopped at the end of a narrow street, which led to the river. To the right below them was a wooden house, the museum-flat of K.E. Tsiolkovskii. By its simplicity it reminded one of the small astronaut houses in Baikonur, which "dreams from moment to moment in the silence of young poplars."

German Titov and Andriyan Nikolaev went up the short narrow staircase which took them to the living room on the first floor. On the wall there was a portrait of the scientist painted from life by the artist V.P. Lubimov. In a glass case was his pocket watch and Nurmis-type skates. Konstantin Eduardovich skated with them for the last time at the age of 76. Nearby an umbrella and a telescope lay. Near the wall was a bicycle; Tsiolkovskii loved to cycle even during extreme old age.

Next to the bright living room was the work study of the scientist. Titov approached the writing table, which stood on a pier between two windows. A kerosene lamp with a small mirror used as a reflector to intensify the illumination. A small globe. A camera. On the wall, a barometer. Seeing a home made tin "listener" on the easy chair, the astronaut asked:

"Can I take it in my hands?"

A.T. Skripkin, the curator of the museum replied:

Hero of Labor of the Democratic Republic of Vietnam G.S. Titov in the DRV Embassy.

"Please do."

Putting the listener to his ear, the way Tsiolkovskii used to do, German addressed Andriyan:

"Speak a few words in whispers."

"How simple everything is here..."

"Really, you can hear as clear as if somebody was beating a drum..."

The astronauts stood a long time near the bookshelves: belles-lettres and scientific literature. And here too the works of Tsiolkovskii himself and many of his followers with presentation inscriptions. To send one's book to Konstantin Eduardovich was considered an honor. The first published work of the future Academician S.P. Korolev "The flight of rockets in the stratosphere" must also be here. Konstantin Eduardovich wrote about this booklet in February 1935: "S.P. Korolev has sent me his book 'The flight of rockets,' but does not indicate his address. I do not know how to thank him for his kindness. If it is possible, convey my thanks to him and let me have his address. The booklet is interesting, judicious, and useful..."

The astronauts spent about an hour in the work study. The easy chair, in which the scientist liked to work (putting plywood under a sheet of paper), the table with scientific instruments, astronomical telescope, the small

bedstead, and the room itself, a little over twenty square meters in size—all this spoke of the surprising modesty of a great scientist.

The guests were invited into the "scientific laboratory." From a small veranda opened a view of the mirror-like surface of the Oka River. A joiner's bench and lathe: this was the scientist's workshop. And here was a small porthole, leading to the gently sloping roof of the house. Konstantin Eduardovich jokingly called it "the door to the universe."

The astronauts went downstairs. German Titov stopped suddenly and as if summing up his impressions remarked:

"The designer's bureau is a small one, but how many brilliant, daring projects were born here!"

"And how many sleepless nights were passed by Tsiolkovskii here," added Nikolaev.

The astronauts stood for a long time near the designs and models of space rockets working on liquid propellant, interplanetary craft, rocket-trains and airships. Can anyone remain unmoved at the contrast between models of obsolete petrol-engined aircraft (even with auto pilot) and the schemes of artificial satellites of the earth...?

The hours passed by unnoticed. But before leaving the house Titov and Nikolaev returned to the room.

German Titov stood at the photocopy of the famous "Tsiolkovskii Formula." Without its knowhow the launching of both artificial earth satellites and spacecraft would be impossible. The formula was published over sixty years ago in the paper "Rockets into outer space", which received widespread recognition. The astronaut remembered the lines in the textbook: "The final velocity of the rocket depends on the speed of the exit of burnt products from the engine jets and the ratio of the weight of the propellant to the weight of the empty rocket. The speed of the exit of gases depends on the chemical composition of the fuel. The ratio of the weight of the propellant to the weight of the empty rocket is called the 'Tsiolkovskii Number.' This relation is the most important characteristic of the rocket."

By its side is the text of the resolution of the All-Union Central Executive Committee of the USSR concerning the award of the Red Labor Banner Order to K.E. Tsiolkovskii. The Order was presented to the scientist by M.I. Kalinin on November 27, 1932 in the Kremlin. "I can show my gratitude to the State for this high award only by my work. There is no sense thanking only in words." With these few words and a firm handshake to Mikhail Kalinin, Konstantin Eduardovich replied to his recognition by the party and the government.

The last room. A recording is played. The muffled voice of the owner of the house resounds:

"For forty years I have been working on jet engines and thought that the

A quiet minute.

walk on Mars would take place only after many centuries. But the times change. I believe that many of you will witness the first travel across the atmosphere."

The exciting speech of K.E. Tsiolkovskii's in May 1935, is preserved for posterity and was recorded a few months before his death.

Tsiolkovskii's grandson Aleksei Kostin requested the astronauts to leave their impressions in the visitors' book. German wrote "The pursuit to which K.E. Tsiolkovskii dedicated his life, is the pursuit of all the people of the earth, the cherished dream of the whole of humanity..."

Meanwhile, the air show program had come to an end. "Now let's go to the exhibition," said Titov. "I hear there's a lot of interesting stuff there. Will you come?"

The exhibits—aircraft of every type and purpose stood in line on the vast green square. Titov went up to every machine, read aloud the details, and added his own remarks. The astronaut's wife Tamara and his sister Zemphira along with ourselves constituted that small group of privileged visitors, to which our guide addressed his expert remarks.

"We must definitely climb aboard 'Antei', and stroll along inside its cabin. You can yourselves judge its dimensions. It can hold three big passenger buses. Even a Pullman railway wagon or a river craft with underwater wings can be accommodated in it."

Titov's voice rang out triumphantly when our group went into the gigantic aircraft and German literally looked into every nook and corner. At the same time he told about his Kiev meetings with Oleg Konstantinovich Antonov, the designer of "Antei" and other aircraft of the "AN" series.

From the top of a four-storey building a panorama of the airport exhibition with its festive decorations opened out. German continued explaining fervently but convincingly, with that authentic passion which speaks of a man's unlimited love for his work...

HOW THE ASTRONAUTS WERE TRAINED

At the time when the question of the first flights of man in space was being decided, specially flights for prolonged periods, the scientists discussed from all angles who would be most suitable for this type of experiment. All agreed that physically and psychologically strong people were needed.

During orbital flight the astronaut would have to contend with the effects of various unfavorable factors, connected with the dynamics of spacecraft flight. This included noises, vibrations, considerable high-gravity forces at the time of entry into orbit and on return to earth, weightlessness, vestibular stimulants acting for long periods, caused by the rotation and oscillation of the spacecraft during its motion. Other factors, connected with the conditions of the astronaut's stay in the spacecraft cabin had also had to be considered, viz: specialities of the microclimate, isolated stay in a confined space with limited movements, the possibility of rise in temperature during an emergency; peculiar food, intensive routine of work and abnormal dress; it was impossible to forget about the nervous-psychological tensions caused by

the novelty and uniqueness of the situation, the complete difference from conditions of the earth, the necessity of taking crucial decisions in a complex situation. The astronaut must be able to orient himself in case a complicated situation arose and if necessary take part in controlling the spacecraft. Thus the highest demands were made on the health of the astronaut, his psychic qualities and the level of general and technical training.

The scientists and specialists came to the conclusion that the first group of astronauts must be selected from pilots. The future astronauts were subjected to a thorough medical checkup. The reserve capacities of the organisms were judged at the time of investigations in the altitude chamber, with its considerably high rarefaction of air, drops in barometric pressure and breathing with oxygen under increased pressure, as well as during the investigations in the centrifuge and on the vibrostand.

Astronauts had to have good memory, a sharp wit, attention which is active and can easily be switched over from one subject to another and the ability to make quick, exact and coordinated movements.

After a clinical physiological checkup on thousands wishing to become astronauts, a detachment was formed which began training for the first space flights.

The scientists understood that the orbital flights, particularly the first one, would require mobilization of all the physical and psychological forces of the astronaut. Therefore the drive to raise the resistance of the organism to the effect of space flight factors, cultivation of the necessary skill for controlling the craft, the work of its systems and units and theoretical training, became the main principles forming the core of the astronaut's training program.

The doctors reproduced isolated elements of space flight or their combinations, in ground conditions, and at the time of flight in aircraft flying along a trajectory where short duration weightlessness occurred. They determined the effect of these elements on the human organism, and worked out the methods of raising the resistance of the organism.

The program of astronaut training was made up of a set of special tests with an allround physical preparation and theoretical courses of study, which included the following subjects: principles of rocket and space technology, the construction of the spacecraft "Vostok", special courses of astronomy, geophysics and space medicine.

The set of training tests included flights in aircraft in conditions of weightlessness, training in the simulator of the "Vostok's" cabin and in other special trainers, prolonged stays in a specially equipped soundproof chamber, tests and training in the centrifuge, tests and training in the thermochamber under conditions of high temperature, tests on the vibrostand and parachute training.

The reaction of the astronauts to short duration weightlessness and change

from weightlessness to high gravitational force was investigated at the time of flights in special aircraft. The coordination of movements, sharpness of vision, capacity to take food, conduct radio communication, etc. was studied. This helped in answering a number of important questions, connected with human behavior under orbital flight conditions. It was established that the selected astronauts should bear weightlessness well for a period of 35–40 seconds and under such conditions be able to find their correct bearings in space and carry out delicate coordinated movements, like taking down notes in the aircraft journal, conducting radio communications and reading.

While undergoing training in the spacecraft cabin simulator and in the special trainer, the astronauts studied the equipment and apparatus, worked out different variants of the flight schedule and generally got accustomed to staying in the cabin. The instruments with the help of electric modelling devices showed the data which reflected space flight conditions. This helped the astronauts practise controlling the spacecraft in abnormal situations.

The investigations during the prolonged stay in solitude in a soundproof chamber with considerable reduction in external stimuli permitted the spotting of persons possessing high indices of accuracy and clarity and having a more stable neuro-psychic integration in accomplishing the set tasks.

The tests in the centrifuge and heat chamber showed how every astronaut bore high gravity forces and high temperatures. The effect of the given factors on the basic physiological functions was studied. The question of raising the resistance of the organism to high-gravity forces and the influence of heat was solved.

The training parachute jumps occupied an important place in the program because one of the methods of the astronauts' return to earth envisaged ejection and descent by parachute with a landing on earth or over water.

Specially selected gymnastic and acrobatic exercises were combined with sports, swimming, jumps into water and exercises on apparatus. As a result, the astronauts' general capacity for work and endurance went up considerably and the indices characterizing the strength of muscles and coordinations of movement, improved.

After this training the pilots changed over to studies connected with preparations for the space flight. These included: study of the flight task, the map of the landing area, instructions about the technique of piloting the craft and conducting radio communications, etc.; the study of survival kit, its utilization at the location after landing, the study of the direction-finding system, etc.; tests in the centrifuge in spacesuits at the maximum value of the expected high gravity forces; prolonged tests in a hermetized simulator of the "Vostok" with utilization of the lifesaving systems.

As a result of the study-training, a group of astronauts was selected ready for orbital flight.

During training.

25 HOURS OF FORTITUDE

The successful completion of Yurii Gagarin's flight and the positive data about the "Vostok's" performance, allowed preparations for a second space flight. The scientists planned to achieve a 24-hour flight by the spacecraft "Vostok-2". This was the next step in the flight program of man in space. The 24-hour flight permitted the investigators to explain the influence of the least studied factors of space flight, of the prolonged condition of weightlessness (for several hours) on the organism and its capacity to work.

Several contradictory opinions were expressed about the influence of prolonged weightlessness on man's orientation in space, his movement coordination, the functioning of his cardiac, vascular and digestive systems and his psychological condition. First it was necessary to explain the effect of weightlessness on blood circulation and breathing and establish for what period weightlessness would be harmless for man. The solution of such questions on the ground was very difficult, since the creation of equipment to reproduce weightlessness on earth is technically an extremely difficult task.

The scientists considered it was imperative to study how the most important physiological processes, connected with the 24-hour period and 24-hour rhythm of life would run their course. For example, the changeover from sleep to waking, work and rest, the period of taking food, the influence of the unusual rhythm of space day and night. These investigations arose out of the need to perfect a system of selection, preparation and training of people for prolonged flights.

The longer duration of the scheduled "Vostok-2" flight added to the astronaut's volume of work. The flight task included: manual orientation of the craft in space, visual observations of earth and space, taking movie shots through the portholes of the cabin; maintaining radio communications with the stations on land; making a number of medico-biological investigations; physical exercises, taking food, etc. The routine of the astronaut's day was arranged in such a way that the customary, "earthly" rhythm of vital activity was preserved.

It was envisaged that the spacecraft would come down at the beginning of the 18th circuit with the utilization of the automatic systems if the flight was normal. According to his judgement the astronaut was permitted to eject himself from the cabin at a suitable height above the earth's surface and then parachute down.

Before describing the landing, however, we should mention what had been done to safeguard the astronaut from radiation.

The medico-biological and physical experiments conducted during the preparation of the first flights of man in space, testified to the safety of staying in orbits running below the radiation belt, but only when the sun was calm.

After a normal jump.

After big solar flares, the intensity of cosmic rays grows high and conditions in near-earth outer space become dangerous to the life of the astronaut. Even during comparatively short flights, the possibility of the appearance of solar flares with dangerous radiation is very great.

During the period preceding the launching of the "Vostok-2," as well as during the whole flight, astrophysical observatories and solar physics stations situated in different parts of the Soviet Union, continuously observed the sun. The intensity of cosmic radiation in the stratosphere was registered with the help of airborne probe-balloons. All the information was processed immediately.

For controlling the condition of radiation on board "Vostok-2," a radiation dose-measuring apparatus was kept, whose readings were transmitted to observation points on earth. Also the astronaut had a dose meter, which allowed him to measure the total dose and evaluate the nature of the radiation. It was possible to take a decision about urgent landing of the spacecraft if the dose meter on board showed an unforeseen rise in the level of radiation.

The radiation condition in near-earth outer space remained favorable before the launch and during the flight of "Vostok-2." The readings showed that the total dose of absorbed radiation in the cabin of the craft was considerably lower than that permissible.

The honor of taking the second flight into the vasts of the universe went to pilot-astronaut German Stepanovich Titov.

On August 6, 1961 at 0900 hours "Vostok-2" was launched. The craft joined a near-earth orbit with the heights: perigee—183 kilometers, and apogee—244 kilometers.

During takeoff, high gravity forces, rocket vibrations, noise from the running engines, all had their effects on Titov, as they had on Gagarin. Astronaut-2 bore the influence of these factors completely satisfactorily. During the first minute of weightlessness he had a feeling he was flying upside down, but after a minute or so this feeling disappeared. Astronaut-2 took off his gloves, opened the pressurized helmet and checked the condition of the equipment.

In accordance with flight instructions, he switched on manual control at 1000 hours and oriented the craft in space. Evaluating the effectiveness of manual orientation Titov said, "To control the craft is easy and convenient; it can be oriented in any given position and can be turned at any moment in the required direction. I felt that I was the master of the craft. It was obedient to my will, and responded to my hands." During the 7th circuit manual control was tested for the second time.

At the beginning of the 2nd circuit the astronaut started observations and shooting a movie film of the earth's surface and the starry sky. The shooting continued during the whole flight through the portholes in separate sequences.

The films of the earth's surface proved to be valuable material for meteorologists studying the nebulous fields, since the perspectives of meteorological investigations with the help of earth satellites could now be evaluated.

During the 3rd circuit at about 1230 hours Titov had his lunch and on the 6th he dined. Mashed products, put into soft tubes, constituted the main part of the food ration. These tubes contained soup-puree, meat and liver paste, processed cheese, black currant juice, coffee, etc. Bread was baked in the form of small balls. Water was kept in a container made of polythene, which allowed it to be used completely freely under conditions of weightlessness.

During the flight the astronaut was regularly engaged in radio conversation with communication centers on the earth and made notes in the spacecraft journal. According to the tasks set by doctors, he undertook tests four times for studying the vestibular organs, which, as is well known, play an important role in the orientation of man in space and in the strict coordination of movements in weightlessness. The results of psychological tests and self observations, the quality and completeness in fulfilling the flight tasks, helped the doctors to draw conclusions about mental efficiency and the conditions of higher nervous activity of the astronaut at the time of a 24-hour orbital flight.

The long stay under conditions of weightlessness did not cause any pathological derangement in the astronaut. Only some changes on the part of the vestibular organs were noticed, which appeared as unpleasant feelings. However, when the astronaut returned to the initial pose in the chair and did not make abrupt movements with his head, this feeling disappeared.

In spite of the complexity of the flight and saturation of the program, the pilot's efficiency was preserved on a high level.

The lifesaving systems of "Vostok-2" worked normally. The astronaut regulated the temperature of the cabin himself. It changed from 10 to 25 degrees centigrade.

On the morning of August 7 during the 17th circuit, the automatic system oriented "Vostok-2" in the direction of the sun and switched on the retro-rocket. The craft left the orbit and began its descent. Then followed the separation of the instrument and recovery sections. After passing through the region of high temperatures and high-gravity forces, when the speed was already decelerated, Titov ejected and at 1018 hours came down by parachute near the settlement Krasnyi Kut in the Saratov region. The total duration of the flight had been 25 hours 18 minutes.

Titov's flight on the "Vostok-2" proved that man fully retains his efficiency in the course of a 25-hours stay in space. The reliability of the rocket-space complex "Vostok", and the correctness of the ideas which underlay its design was once more confirmed.

1961—1971

Andriyan Grigor'evich Nikolaev,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On August 11, 1962, in the Soviet Union, the spacecraft "Vostok-3" was put into orbit as a satellite of the earth. "Vostok-3" was manned by pilot-astronaut Air Force Major Andriyan Grigor'evich Nikolaev, a citizen of the Soviet Union.

"VOSTOK-3"

For making the world's first prolonged group flight in outer space in the satellite-spacecraft "Vostok-3" and "Vostok-4", the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Major Andriyan Grigor'evich Nikolaev.

* * *

For making a prolonged group space flight in the satellite-spacecraft "Vostok-3" and "Vostok-4", the title of the "Pilot-Astronaut of the USSR" is conferred upon Air Force Major Andriyan Grigor'evich Nikolaev.

* * *

FROM THE HERO'S LIFE

Andriyan Grigor'evich Nikolaev was born on September 5, 1929 in the family of a poor peasant, in the village of Shorshely in the Mariinskii-Posad District of Chuvash ASSR.

In 1944 he finished the seven year Shorshely secondary school. The same year he joined, and in 1948 finished, the Mariinskii-Posad Forest-Technology School and specialized as a Technician-Forester.

From December 1947 until April 1950 he worked as a forest range foreman in the Derevyanskii timber industrial unit of the "Uzhkarelles Trust".

In 1950 he was drafted into the army and sent for training in the Air Force Flying School. From 1955 he worked as an Air Force Pilot.

He was awarded the Order of the Red Star in 1961 for the successful fulfillment of tasks set by the government.

A.G. Nikolaev, graduated from the N.E. Zhukovskii Air Force Engineering Academy and became the commander of the detachment of astronauts after Gagarin. The astronaut is a Deputy of the Supreme Soviet of RSFSR.

MAN OF IRON TENACITY

The big Kremlin Palace has a regular session of the Supreme Soviet of the Russian Federation in progress. A young Colonel with the Gold Star of Hero of the Soviet Union is sitting in the center of the hall. He bends forward a little. From under the thick black brows, dark shining eyes gaze attentively. On the rostrum is a representative of his native land of Chuvash. He is making a report to the Deputies; how the Republic is prospering from year to year, how it is gathering strength. In the fraternal family of the people of Russia, autonomous Chuvash is one of the members of the concord of nations forming the Russian Federation, and enjoys equal rights. Its people achieved success in the construction of communism.

... Andriyan Nikolaev remembered his native village Shorshely, the River Big Tsivil, which falls into the Volga, and the capital of the Republic, Chebuksary. Almost twenty years have passed since he left his homeland. And could he, the son of a collective farmer, think at that time that here in the Kremlin together with others elected by the people, he would have to decide important State matters? He remembered his mother's kind face,

covered with wrinkles and her advice while parting : "Work in such a way, that people may praise you. The praise of people is more valuable than gold."

The astronaut smiled. These words his mother had repeated to him again and again : when he became a pilot, and not long before his first flight in space, and also after she came to know that the people of Chuvash had elected her own son as their Deputy.

Discussions about the reports have come to an end. The presiding member puts to the vote the State plan project for the economic development of RSFSR.

"Comrades, Deputies : Those for the plan of economic development, please raise their mandates." Then glancing over the big hall, he continues :

"Those against? Abstentions? No one against and no absentations. The plan of economic development of the Russian Federation is approved unanimously."

Pilot-astronaut Andriyan Nikolaev, one of the first Soviet conquerers of space, also voted for it, carrying out the will of his electors. The new economic plan of the Republic meets his interests both as a Deputy and as an astronaut. The plan envisages considerable grants for the development of science and technology, which means research as well as travel in space.

...Our first fleeting meeting. We sat in the small house at the Baikonur cosmodrome and conversed with German Titov. It was the evening of August 5, 1961. A heavily built pilot entered. Brown eyes flashed from under the peak of his cap. He kept quiet waiting for a momentary pause in the conversation. He addressed Titov :

"Excuse me, comrades. German, people from the communication group have come, what should I tell them?"

"I will be at their disposal in a few minutes." And when the pilot left, German Titov said in a surprisingly tender voice.

"My double, Andriyan Nikolaev. You will meet him again. A man of amazing equanimity and iron self-control. His motto is 'the main thing is calmness'."

"The main thing is calmness" .... We were destined to hear these words from the astronaut himself when he told us details of his life, albeit sparingly, after the flight.

"As you know, I finished the forest technology school in my native Chuvash, then I was forced to leave Shorshely. In Russian it means 'a clear spring'. I was sent to work in Karelia, in a forest industrial unit. What forests we have there ... I liked the new place. I thought then that I would stay for a long time. But the time for army service drew near. At the draft-center the doctors examined me for a long time, almost an hour. And then I heard the short verdict: 'To the Air Force.'

"The way into the sky is not easy. Ask any pilot. Study wasn't easy and

I had to pass all the levels. At first I studied the course for air-gunners. I joined the Air Force Flying School in August, 1951. It seems all this wasn't so long ago, but ten years have passed.

"Service in my regiment started in the environs of Moscow. I shall never forget my meetings with Pokryshkin, Hero of the Soviet Union with two bars. In my youth I had heard a lot about him, but never thought that I should ever see him. Certainly the question of serving under his command never entered my head. During those years I was accepted as a candidate for membership of the party. A few days before the launching of the first artificial earth satellite in September 1957 I became a member of Lenin's party."

The communist who recommended Nikolaev's name for the party cadre, wrote with confidence : "I know Senior Lieutenant Andriyan Grigor'evich Nikolaev well, having served together with him from 1955 till the present. Comrade Nikolaev is a disciplined, efficient Pilot-Officer of the Air Force and enjoys authority among the personnel of the unit. He constantly tries to increase his military and political knowledge and flies with skill and competence."

The person who wrote the recommendation did not know then that he was also giving the pilot a pass into outer space. During the selection of candidates for the first detachment of astronauts this testimonial played its part. However, the communist had a firm basis for writing what he felt.

... A little before the party meeting Andriyan Nikolaev had carried out a routine flight for perfecting flying technique at a height of 10,000 meters. Everything went normally, the plane was under control. Suddenly when the flight program was completed, the pilot felt a sweeping silence, as if the light-winged MIG was hanging for a second : the engine had failed! Nikolaev looked at the instrument panel : the revolutions were falling. With a quick move he pulled back the stick and brought the machine into a horizontal flying position, then into a glide and turned in the direction of the airdrome. The fuel sector was not obeying. The altimeter needle was creeping toward the lower line. The ground was coming closer and closer. Again and again the pilot tried to switch on the turbine but all in vain.

One can imagine the feelings of a man stranded in a falling aircraft.

"The engine has stopped", the pilot reported to the flight instructor with as much composure as possible.

And during those short seconds a thought pierces his consciousness : "the end of the machine". And at the same time another, stronger thought, which pushes the first into the background. "Have I done everything? The main thing is calmness." Nikolaev clenched his teeth as the earth loomed nearer and nearer.

The pilot heard the voice of the flight instructor. "Stop trying to start the engine."

"Aye, Aye, Sir." Nikolaev answered automatically, thinking to himself, "Not to hurry, the main thing is calmness."

He knew he had only to press a button and the automatic system would throw him out of the aircraft. The plane would crash and become a heap of metal. He would be alive but the plane would be smashed to smithereens. "No. No. There is still time. After all this is a machine built by people."

In the earphones the order came to abandon the machine.

In the tense, narrowed eyes of the pilot, appeared a cold lustre : Andriyan Nikolaev had decided to try to land the MIG. He asked control for permission but was told : "You cannot reach the landing strip."

"Then I will bring her down in a field."

There, on the ground, his comrades understood everything. Only expert flying skill and iron self-control could save the pilot and the craft. And all this time his mother Anna Alekseevna, who had come to visit him, was sitting in his bachelor quarters. She did not suspect anything and thought her son was engaged in the routine work of a pilot.

...Later on, when everything was over, Andriyan Nikolaev spoke to his pilot friends in his customary manner : simply and deliberately.

"A little to starboard I noticed a field. There were no trees, the place looked even. I was excited and at the same time not excited. 'Keep calm'— I kept telling myself. Coming nearer the ground, I saw that the landing strip was in fact quite uneven and bristling with bushes. Well, it's not so important. I'll round it. Suddenly I noticed a dip just beyond the field. Well, this was absolutely unexpected. The devil knows what is beyond that, possibly a precipice. If you overrun, that's that. The end. But again, the thought : 'the main thing is calmness.' I simply just stop before the dip. I straightened the plane for my approach. We plowed into the field with a terrific noise. At last we stopped. I looked ahead. Just as I thought! A few more meters and ... a precipice."

A few days later in front of all the pilots the Regiment Commander presented to Andriyan Nikolaev an engraved wristwatch with his name and the following citation : "To reward Lieutenant Andriyan Grigor'evich Nikolaev with the valuable wristwatch 'Pobeda' for the bravery and self-control shown by him in a grave situation arising during flight."

...Since 1960 Andriyan Nikolaev was in the "Star City" with the first group of astronauts, now called the Gagarin Group. A big load fell on the pilots of this group in working out the world's first methodology of the training of men for flight in space. After a few years the doctors and biologists admitted that the first astronauts were prepared with a big reserve of strength. But the main task remained, the mastering of the flight program by a thorough study of all the systems of the craft.

And at last, man's first flight into space. We sit and listen as Andriyan Nikolaev relates about the unforgettable day.

"In the Baikonur cosmodrome the morning was extremely sunny with not a cloud in the sky. We sat in the now-famous blue bus and went to the

launching site. Yurii Gagarin and his understudy, German Titov, were sitting in special chairs dressed in spacesuits. Yura was in excellent mood. And only rarely did the expression of seriousness come into his smiling blue eyes. We understood his emotional state. Pavel Popovich, Valerii Bykovskii and I did not hide our happiness at the fact that our friend was flying into space. We had complete faith that he would fulfil the tasks set him by the party and the government. I do not remember what we spoke about during those minutes. Soon the rocket could be seen ahead. This morning it somehow looked particularly majestic, even festive. The sun, huge as it rose above the earth, illuminated it.

"The bus stopped at the launching site near the rocket. Yurii and German shook each other's hand and 'clinked' with their pressure helmets. We helped Yurii get down from the bus. The moment of parting came. Gagarin embraced Pavel Popovich, Valerii Bykovskii and me and said, 'Comrades, we were always great friends. Our friendship must become even stronger, like a firmly clenched fist. Till we meet again on the earth, farewell dear friends!'

Another second and Gagarin was gone to keep his heroic appointment with space.

"We stood at the observation post. The tension, caused by the countdown for the firing of the rocket, reached its climax. At last the order to fire rang out. The rocket quivered and slowly lifted off. At this moment we heard Gagarin's voice, 'I'm off', as if a silver arrow was piercing the sky. We all shouted, yelled, laughed and jumped like little kids and embraced one another.

"And from space the brisk voice of Gagarin could be heard making a report to Academician Korolev, President of the State Commission and technical guide of the flight, that everything was going according to plan and that he felt excellent ...

"Our happiness knew no bounds. Everyone understood the great significance of the first flight of man in near-earth space. And everyone was very worried. We knew our technology would not let us down, but how would Yura bear the mysterious condition of weightlessness? The 108 minutes of flight seemed like eternity to us, and we were very ill at ease. We all thought deeply during this time: our hearts were full of pride for our beloved motherland, for it was she who first opened wide the doors into space, before other countries.

"At last the long awaited information came, 'the retrorockets have been switched on'. The last and longest minutes pass. And suddenly the cheerful voice of Sergei Pavlovich, 'He has landed!"

* * *

After sixteen months Andriyan Nikolaev became commander of the "Vostok-3". The last minutes in the cabin of the craft. Possibly they are the most difficult.

In the headphones, a known voice, that of Gagarin :

"Everything ready."

"All the best."

"Go ahead."

"Fire! . . ."

The rocket quivered from the blast and rose slowly upward.

Before the flight of "Vostok-3" Academician S.P. Korolev, had given his evaluation of Andriyan Nikolaev :

"Calmness and self-control—this is his motto. He is an excellent pilot and knows his technology thoroughly." These words were fully corroborated by the long journey of Andriyan Nikolaev in the "Vostok-3" in a group flight with the "Vostok-4" craft which was piloted by Pavel Popovich.

General N.P. Kamanin said about his pupil, "I like the modesty, simplicity, sincerity, calmness and the real bravery of this man."

Many years have passed since the memorable days of 1962. From being the commander of a craft Andriyan Nikolaev has grown to be the commander of the astronauts. During this period he also completed his engineering education.

. . . "Star City." Near the entrance to the city stands a cheerful building : on the second floor a small room. This is meant for the reception of the electors by Astronaut-Deputies of the Supreme Soviet of the USSR, RSFSR and Ukraine Republic.

Today Deputy of the Supreme Soviet of the Russian Federation, Andriyan Grigor'evich Nikolaev is receiving.

"It is an honor to be an elected representative of the people", he states, "but not easy. Look at this bunch of letters. Not only the workers of Chuvash, but of the whole Soviet Union write to me. Every letter is full of life's complexities and happiness, joys and sorrows. Some express their wish to know how life can be made more colorful, others need some advice, the third group points out defects in the working of enterprises or institutions . . . the fourth writes to me about their personal problems."

"Everyone must be given a detailed reply and with some it is necessary to talk things over. I go to my birthplace quite often and meet my electors, to give an account of my work for them. Quite a large number of people came here too, to the 'Star City'. At the same time, there is nothing I enjoy more than meeting the people."

"And of course, there must be letters with the request to join the detachment of astronauts?"

"There are plenty", smiled Nikolaev. "The men write to me, and the women to Valya."

A soft knock on the door could be heard. A visitor entered the room.

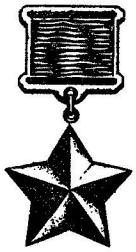
"Permit me, Andriyan Grigor'evich?" The Deputy's day had begun. . .

Pavel Romanovich Popovich,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On August 12, 1962, in the Soviet Union, the spacecraft "Vostok-4" was put into orbit as a satellite of the earth.

The spacecraft "Vostok-4" was manned by pilot-astronaut Lieutenant Colonel Pavel Romanovich Popovich, a citizen of the Soviet Union.



"Vostok-4"

For making the world's first group flight in outer space in the satellite-spacecraft "Vostok-3" and "Vostok-4", the title of the Hero of the Soviet Union is conferred upon pilot-astronaut Lieutenant Colonel Pavel Romanovich Popovich, with the award of the Order of Lenin and the Gold Star Medal.

* * *

For making a prolonged group space flight in the satellite-spacecraft "Vostok-3" and "Vostok-4", the title of the "Pilot-Astronaut of the USSR" is conferred upon Air Force Lieutenant Colonel Pavel Romanovich Popovich.

* * *

FROM THE HERO'S LIFE

Pavel Romanovich Popovich was born on October 5, 1930 in the family of a worker in the Uzin settlement, of Kiev region.

He studied in school and then in a trade school in Belaya Tserkov'. After finishing the trade school he joined the Magnitogorsk Industrial Polytechnic. By 1951, he was a qualified building technician.

After completing training in the Air Force Aviation College he served in the Air Force.

In March 1945 he was admitted into the ranks of the LYCLSU. He became a member of the CPSU in June, 1957.

He was awarded the Order of the Red Star in 1961 for successfully carrying out tasks set before him by the Government.

P.R. Popovich graduated from the N.E. Zhukovskii Air Force Engineering Academy. The workers of the Ukraine SSR elected him Deputy of the Supreme Soviet of the Republic.

THE JOY OF A COMMUNIST

PAVEL Popovich was working steadily in the "Vostok-4" accurately fulfilling the flight program, reporting his observations and maintaining communications with "Vostok-3". Every one of his radiograms and instrument readings testified to the fact that the "Golden Eagle" was performing excellently. He not only put in a lot of work, but even snatched time to study physics and some English language.

And the cheering words of Yurii Gagarin, addressed to Nikolaev and Popovich, were resounding in space, "Everything is O.K. friends : Congratulations! Till we meet on earth."

Yurii Alekseevich was at mission control and attentively followed the flight of the "space duet".

When Gagarin flew, Popovich had been his "messenger," and the first astronaut had maintained contact with his comrades and with the cosmodrome, through him.

"It was nice that Popovich was made the 'messenger,' he is a sincere and cheerful man," Yurii Alekseevich had said. "As if by instinct he understood

when and what to relay to my space 'home'. Before the blast off while I was sitting in the cabin, Pavel asked me, cheerily :

'Yura, are you getting bored in there?'

'If there is some music, then play it', I replied.

"After a minute I could hear my favorite songs. Pavel knew my taste.

'Shall we sing together this evening?' he asked me jovially. I answered :

'O.K.'

"For about five minutes Pavel could not be heard. I even thought, 'Well now, where have you got to.' And suddenly I heard :

'Yura, a collective good morning to you from all the boys. I was with them just now.'

"I understood. 'Thanks a lot. Give them my heartfelt good wishes.'

"And then more music and friendly parting words.

'The boys are very satisfied that everything is O.K. with you,' said Pavel.

"And just before the takeoff he again succeeded in barging in on the general conversation.

'Everyone wishes you all the best.'

"At that time I thought, 'how great to have such friends!' During the flight I also heard Pavel's voice, and it seemed as if I saw his kind face," ended Yurii Alekseevich.

... Popovich was the first to join the detachment of astronauts. In fact, at that time there was neither a group, nor a detachment.

"Receive your comrades," the commander, Colonel E.A. Karpov told him. "Fulfil the role of Quartermaster."

As a hospitable host, Pavel Romanovich received Yurii Gagarin, German Titov, Andriyan Nikolaev and others.

Popovich helped the pilots in arranging their lodgings. Under his guidance as team leader, they mounted equipment and set up instruments and assembly units. Already at that time everyone was convinced of Romanych's (as he was called by his comrades) endurance.

The commander took into account Pavel Romanovich's flair for organization and his indefatigable, bubbling energy. The appointment of Popovich as the senior man of his group was taken for granted.

Once Yurii Gagarin said, "Popovich is a very tactful, sympathetic person. To think about other people and to help them is a part of his character ..."

The comrades elected Popovich as their leader for Communist Party affairs.

Speaking about Pavel Romanovich, Colonel Karpov stressed :

"Everything interests Popovich; he approaches every subject with keen interest. The characteristic traits of the astronaut are frankness and persistence in achieving his goal."

For a long time the first party meeting of the group was remembered in the detachment. It was conducted by Pavel Romanovich.

Those communist pilots, who had been till recently members of the Young

Communist League, had collected. Having entered the ranks of the CPSU, everyone of them took active part in the life of the party organization in his unit or subunit. But now the communists had to solve new problems. Till now not a single party organization had to deal with the question of preparation for man's flight in space and of the life and training of those people who had to assail the universe.

The meeting turned out to be an interesting one. People spoke with passion; suggestions were made how the teaching and training could be better organized and living conditions could be improved. Naturally, in those first days there were a number of problems.

The communists united and closed the ranks of the collective and led it forward. Romanych was the life and soul of all this effort.

... Popovich's childhood was passed during the war years. The Nazis attacked his native Uzin, when he was eleven. The school was closed. When our armed forces started advancing, the Nazis became all the more ferocious. They were so afraid of the patriots' revenge that they suspected every grown up man and even a schoolboy of being a guerrilla. Our people advanced and the youth's happy schooldays started again. But life was hard. Only his father was working and there were four children in the house. His sister Mariya returned from the enemy occupied territory in a completely run down condition and could not help the father.

Without leaving school, Pavel started working as an assistant to the fireman at the factory where his father worked. The day he was admitted to the trade school in Belaya Tserkov' was a joyful day for him. In 1947 Popovich became a joiner and simultaneously passed the seventh class of the evening school. In the school rolls on page 35 it is written, "Pavel Romanovich Popovich, born in 1930, finished school on July 31, 1947. He was awarded the qualification of Joiner—Fifth class." It was not easy for everyone to attain such a high class. Perseverance and persistence helped Pavel in becoming a master of his trade.

Peter Timofeevich Ivanov the remarkable joiner-cabinetmaker, was at that time the teacher of production training. Pavel owes a lot to him for a working grasp of his subject. The astronaut is proud of his joiner's profession and his teacher speaks highly of Pavel's mastery.

"It seems only recently I held in my hands a carefully made stool, Pavlusha's first independent job."

Having come to know of his pupil's flight in space, the teacher said with animation: "Then we had an interesting conversation. 'Well now,' I told him, 'you already have the experience, soon you can learn to make cupboards and chairs.' But he only replied : 'I want to study further.' "

P.T. Ivanov and other trainees of the trade school supported the young man in his yearning. It is not easy to enter the Magnitogorsk Industrial Polytechnic, since there was a large number of labor reserves wishing to

study there. But all the same Pavel got himself enrolled. No doubt, unexpected difficulties cropped up. Till now Popovich had studied in the Ukrainian language, while here the medium of instruction was Russian. But his new comrades spared neither time nor efforts to help him out with Russian. Pavel grasped everything quickly and surely and soon changed over from "satisfactory" gradings to "good" and "excellent".

Popovich plunged into the life of the Young Communist League with enthusiasm. He never refused extra work, and would request that more and more new jobs be given to him.

Apart from singing in an amateur choir, his passion was training in the flying club. The youth's day started at four in the morning when he had to hurry to the airdrome. After flying sorties he came in time to attend classes in the polytechnic by nine. Then practical training : carpentry, plasterwork and stonework.

P.R. Popovich's name is included in the list of pilots who finished Magnitogorsk Flying Club in September, 1951. The gradings are : aircraft—"excellent", motor—"excellent", aeronavigation—"excellent", flight theory—"excellent", manual about execution of flights—"excellent". It was natural that Pavel had excellent testimonials for joining the Air Force Aviation College.

After completing the Air Force Aviation College, Popovich joined a squadron, where he proved himself a brave and capable pilot.

In 1957 the local party organization admitted Pavel Romanovich as a member of the CPSU. When the party membership card was handed over to Popovich, he said :

"I shall justify the faith of the party, I shall live and work, as befits a communist."

As befits a communist! From the first day of his arrival in the astronaut detachment, Pavel Popovich had been living and working exactly in this manner. Pavel Romanovich set an example of personal assistance to every pilot preparing for a space flight. Kind and careful attention toward comrades soon became a tradition. The astronauts made their own traditions though obviously, much was introduced from aviation.

"Our most important tradition is friendship", Popovich said. "To tell one another honestly and openly the truth has become a tradition. We have unofficial meetings. They cannot be called either party or squadron meetings. They can be called simply 'a get-together'. Let us say a comrade took some wrong action, made a mistake in something, or suddenly started putting on airs. So somebody (not necessarily the commander) gets up and says, 'Boys! Today we must have a get-together!' We assemble, but nobody asks what for. We must, for that is the tradition."

"At these get-togethers, everyone who deserves it, gets it pretty hot, be he Titov, Popovich or Nikolaev!"

P.R. Popovich
with Ukrainian schoolboys.

"This tradition is a very good one, and we shall maintain it, because it is of so much practical value. In any collective, one has always to approach the people and solve problems in a very concrete manner..."

As secretary of the party organization Pavel Popovich gave much attention to the upbringing of the Young Communist League members.

Once a hot debate about happiness started in the YCL meeting. It went on for a long time. In conclusion the party organizer said :

"According to me, man should himself bring his happiness closer. In other words, one must enter life as early and as bravely as possible; one should remember that the future is made by one's own hands. Unripe and green are the adjectives used for youth ... but we know, that Shehors commanded a regiment at the age of twenty, and Tukhachevskii commanded the army at a little over twenty. We know of young professors who are Doctors of Science. We also know about young designers of spacecraft. Are they exceptions?'

"Let us develop our theme. Tell me, could Yurii Gagarin be fully developed, become mature, had he spent his younger days not in the whirlpool of life, but under the wings of parental care? You know his story :

at the age of sixteen he was already a metal-worker and soon to be a pilot . . .

"Some people, particularly the younger ones, think that astronauts are very special people. On the other hand, others think that to leave for space in a rocket, all that is needed is excellent health. But the truth is far from either view. It has fallen to our lot to pave the way. Training and fortitude is needed. Fortitude is required for every first step . . . We knew what we were choosing. On this path there is no place for fear. We know, there can be no exploration without risk."

. . . The party organizer always served as an example for the other pilots of the astronauts' detachment.

The doctors consider that the most difficult test for every potential astronaut is his stay in the soundproof chamber, the "Chamber of Silence." A heavy door closes behind the person being tested. Only three or four steps separate one wall from the other. No sounds enter this place, the pilot cannot see anyone, the days and nights stretch out wearily. As long as the astronaut is carrying out the program, everything goes well, but then the job comes to an end. How to face the loneliness, the silence? "For a weak person this is a terrible torture," stresses the psychologist-doctor, who has been observing the behavior of Soviet astronauts in the soundproof chamber.

"We all remember well how Pavel Romanovich Popovich 'served' his period in the 'Chamber of Silence,'" recalled the doctor. "We observed him with the help of television, and, do you know, we were amazed! He felt himself completely at home in the soundproof chamber. Early in the morning, accurate to the second, he started physical exercises : running, jumping and various exercises. He gave commands to himself and counted off the time; then said 'let us have breakfast . . .' He started off his day with confidence, a master of the situation.

"And during the free hours he even entertained his doctors. He gave such concerts, that one would listen with delight. For hours on end he would sing airs from operas and musical comedies, or folk songs . . . We recorded his concerts on tapes. During the breaks Pavel used to dance.

"In the evenings he left some time for reading. At first he read serious books on cybernetics, astronomy and physiology. When he got tired, he ordered himself, 'That is enough' and started reading Mayakovskii; from the poem he changed over to Esenin. Then he asked in surprise : 'Is it time to sleep?'"

On the last day Popovich gave the "parting concert," which was again heard by many doctors, sisters and laboratory attendants. He came out of the chamber with a beard, but without looking pinched or pale. The doctor asked :

"Maybe, you would be willing to sit for another two days?"

"Probably, I would decline," answered Pavel Romanovich. "I have tuned myself for a fixed period. Had you set a longer period, I could have sat through calmly. But now, when I have come down to earth it is difficult to tear oneself away from it and retune oneself. Now a breathing space is necessary."

"We knew that a breathing space really was needed. But if this man was told after a few days 'you have to' then he would be willing for any tests," emphasized the doctor.

Popovich set a brillant example of self-control, accuracy of actions and deep knowledge, not only during the preflight training period, but also at the time of the "Vostok-4" flight itself. And how glad he was, when he fulfilled the task expected of him by the motherland!

We remember, how Pavel Romanovich at the time of meeting the journalists after landing, answered the question about his first feelings.

"It is very pleasant to return to one's motherland. It is a feeling that takes one's breath away. If you remember that we spent several days and nights in the craft it will be easy to understand our feelings."

His astronaut colleagues congratulated Pavel noisily and rapturously. His victory was their victory too. At the meeting, held in the Red Square, Popovich not without reason announced from the Mausoleum rostrum on behalf of his comrades :

"We, the Soviet pilot-astronauts, are not assaulting outer space as individuals, but as a friendly, cohesive, collective, which understands its responsibility to the Soviet people, our socialist motherland and the Communist Party as well. Communists constitute the soul of our friendly cohesive collective. As the secretary of the party organization of pilot-astronauts I assure our party's Central Committee and the Soviet Government that pilot-astronauts are ready to carry out any tasks put before them in the future."

... In the central part of the "Star City" stands a pylon with Lenin's portrait, as though Vladimir Il'ich was admonishing everyone who passes on their way to the cosmodrome.

Andriyan Nikolaev and Pavel Popovich also left for space with Lenin mementos. Popovich took with him a portrait of Volodya Ul'yanov, embroidered in silk. This portrait can now be seen in the Lenin Central Museum.

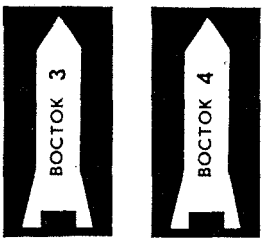
The centenary of the great leader was as solemnly observed in the "Star City," as in every other part of our country. The jubilee medals, "For military valor" were awarded. The award was given to the already famous heroes of space, and to their comrades who have yet to leave a trail in outer space.

Colonel Pavel Romanovich Popovich came smartly to attention for the medal investiture ceremony.

"I serve the Soviet Union!" the astronaut said. While serving in the

detachment of astronauts Pavel Popovich is fulfilling his duty as a communist, and son of the socialist motherland.

"Our future is in flights along new trails, and according to new programs" Popovich told us during one of our meetings. "Astronautics is a combination of thought, skill and bravery; therefore we must continue our studies and training. Also preparations and more and more preparations."



THE FIRST GROUP FLIGHT

THE remarkable space flights of Yu. Gagarin and G. Titov created wide possibilities for conducting new, more complex experiments. They helped in taking the next important step on the path of outer space conquest, that of making a prolonged group flight by Soviet astronauts in the spacecraft-satellites "Vostok-3" and "Vostok-4".

The program of group flight envisaged research and experiments necessary for deciding a number of new medico-biological and technical problems. The scientists proceeded from the expediency of considerable increase in the flight time of the two spacecraft. It was planned to investigate the effect of prolonged outer space flight on the basic physiological functions of the astronaut, his condition and capacity to work.

The single circuit flight by Gagarin and the 24-hour Titov flight did not provide enough material on the influence of weightlessness on the human organism. The investigation of the direct influence of physical factors on the astronauts was substantially hindered by the emotional tension of the astronaut, unavoidable at the time of the craft's exit into the orbit and descent to

the earth. The comparatively short duration of the astronaut's stay in orbit was not enough for the development of processes connected with the contemplated reorganization of the cardio-vascular system under conditions of weightlessness.

It was possible to find out the influence of identical conditions on different organisms, because of the prolonged flight by two pilot-astronauts simultaneously.

Titov's flight on the spacecraft "Vostok-2" proved that it was necessary to supplement and perfect the astronaut's training system for a prolonged flight. Now it was important to check the effectiveness of the training directed toward raising the vestibular resistance of man at the time of prolonged weightlessness.

The most important scientific-technological problems facing scientists were the following : checking and controlling the "Vostok" during a prolonged flight; the working out of the complex of means, which ensured sending out another craft in the zone of the first spacecraft's flight; checking the possibility of establishing radio communications between spacecraft in flight; working out the complex of devices on the earth for controlling a number of craft flying in orbits near one another. The successful completion of group flight had enormous significance for the further mastery of outer space, particularly for deciding the problems of future meetings and linkups in orbit, an outer space operation without which further progress in astronautics was unthinkable.

The flight program of "Vostok-3" and "Vostok-4" envisaged their going into orbit with an interval of 24 hours. The starting time of the second craft depended to a considerable extent on the parameters of the actual orbit of "Vostok-3". It played an important role in bringing "Vostok-4" into the meeting zone with the first craft. It was planned that the group flight would continue for 72 hours.

The astronauts were required : to maintain communication with stations on the earth situated in Soviet territory, and between themselves; to carry out psychological, physiological and vestibular tests; to conduct medical tests : register the pulse, the rate of breathing, the endurance to load factor, appetite, capacity to work; and equipment and the hygienic conditions in the cabin : light, cleanliness of air, temperature, humidity; to judge the peculiarities of food intake and its quality.

The commanders of "Vostok-3" and "Vostok-4" had to change the directions of their craft in outer space, using the manual control system, for carrying out observations of the other craft, the earth's surface and the celestial bodies; they had thus to judge the effectiveness and convenience of the manual control of the craft. They were also supposed to take movie films, etc. If they felt well, the astronauts had to detach themselves every day from the suspension system fastening them in their seats, and "swim freely" in the cabin for

50-60 minutes in each period to judge the convenience of staying under the condition of "free swimming", the possibility and the quality of orientation in space, the convenience of shifting in the cabin, etc.

They were also required to control the working of the apparatus on board, regulate the microclimate in the cabin, carry out scientific-biological experiments, and write down in the spacecraft journal and record on the tape recorder the progress in fulfilling the program and the results of observations.

The launch rocket with the spacecraft "Vostok-3" manned by Pilot-Astronaut A. Nikolaev, blasted off on August 11, 1962 at 1130 hours. At the beginning of the experiment, "Vostok-3" flew in an orbit with the maximum height 234.6 kilometers and the minimum height 180.7 kilometers.

Twenty-four hours later, on August 12, at 1102 hours the spacecraft "Vostok-4", commanded by Pilot-Astronaut P. Popovich, was launched. "Vostok-4" went into an orbit with the heights of : apogee 236.7 kilometers and perigee 179.8 kilometers. The working out of the results of the measurements of the orbit parameters of the two spacecraft showed that the minimum distance between them after the launching of "Vostok-4" was 6.5 kilometers. Such great accuracy in sending out the second craft testified to the perfection of the launch rockets and all the systems of the starting complex on earth. Wide perspectives were opened for the further working out of the assembly operation in orbit.

The astronauts felt themselves well all the time and their excellent performance of the difficult flight-mission testified to their capacity to work. The experiment of "free swimming" in which Nikolaev spent a total of 3.5 hours, and Popovich, about 3 hours, was of particular interest. While "swimming" in the cabin in a condition of weightlessness both of them controlled their orientation ability, carried out observations and maintained radio communications with stations on the earth.

It must be pointed out that the spacecraft commanders did not experience any unpleasant feelings or violation of movement coordination. There is no doubt that prior training played a positive role.

Like Gagarin and Titov, Nikolaev and Popovich did not experience any difficulty in taking food and water. Because of the experience of the two previous flights, it was possible to widen the assortment of products. Fried meat, cutlets, tongue, veal and filleted chicken were included in the astronauts' ration. Sandwiches with pressed caviar, sprat pies and fruits : apples, oranges, lemons, also appeared. There was even dried Caspian roach.

The systems on board the craft worked accurately and the cabins fully maintained the required pressure, temperature and humidity. The amount of oxygen was maintained within the normal limits by the regeneration and air conditioning systems.

The sport for the daring.

The pictures of the astronauts transmitted from the spacecraft were for the first time relayed on the Soviet television network, and to most countries of Europe through "Intervision."

On the morning of August 15 the flight program was completed. The automatic system of descent and landing was utilized for bringing the craft down. At 0924 hours the retrorocket of "Vostok-3", and after 6 minutes, that of "Vostok-4" were fired. After this the craft started descending. At a suitable height above the earth the astronauts ejected from the cabins. According to the prearranged program, both the astronauts landed in Kazakhstan, in the latitude 48 degrees north.

Nikolaev's flight continued for 94 hours 22 minutes and included over 64 circuits around the earth. The flight time of Popovich was 70 hours 57 minutes. He had 48 circuits around the earth to his credit.

The group flight proved the possibility of prolonged stay, normal vital life and capacity to work under conditions of weightlessness for a physically fit person who has undergone the necessary training. It became clear that people could go on even longer outer space sorties. Because of this experiment, other valuable conclusions could also be drawn; for example, if the

necessary systems and means were available for carrying out the operation of meeting and linking-up in the orbit, then this would be a practical proposition.

The experience of ensuring a high degree of reliability and faultlessness in the launch rockets, spacecraft, control rooms on the earth, the trajectory measurements and communications accumulated at the time of the prolonged group flight, proved to be a valuable basis for the further development of manned spacecraft flights.

Valerii Fedorovich Bykovskii,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On June 14, 1963, in the Soviet Union, the "Vostok-5" spacecraft was launched into orbit as a satellite of the earth. It was manned by pilot-astronaut Lieutenant Colonel Valerii Fedorovich Bykovskii, a citizen of the Soviet Union.

"Vostok-5"

For making a prolonged flight in outer space in the satellite-spacecraft "Vostok-5", the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Valerii Fedorovich Bykovskii.

* * *

For making a prolonged space flight in the satellite-spacecraft "Vostok-5", the title of the "Pilot-Astronaut of the USSR" is conferred upon Valerii Fedorovich Bykovskii.

* * *

FROM THE HERO'S LIFE

Valerii Fedorovich Bykovskii was born in 1934 in Pavlov-Posad city, Moscow region.

His fate was entangled with aviation ever since he was 17 years old. When he was still studying in the secondary school, he joined the Moscow Flying Club. Then he got his training in the Kachinsk Air Force Aviation College. He served as a pilot in various Air Force squadrons after finishing the College in 1955.

The Order of the Red Star, and the "40 Years Service in the USSR Armed Forces" and "For Irreproachable Service" medals were awarded to V.F. Bykovskii. In 1959 he was given the title of "Air Force Paratroop Training Instructor".

At the time of the "Vostok–5" flight the CC CPSU considered the request of YCL member Valerii Bykovskii and admitted him to membership of the CPSU.

V.F. Bykovskii is a graduate of the N.E. Zhukovskii Air Force Engineering Academy.

A YOUNG COMMUNIST LEAGUER'S HEART

It has become a tradition since the beginning of the outer space era, that at the time of the Young Communist League congresses, astronauts bring out the LYCLSU red banner. At the 14th Congress it was carried by Yurii Gagarin, at the 15th by Aleksei Leonov and at the 16th by Vladimir Shatalov. The Young Communist Leaguers have also established another tradition—they elect the heroes of outer space as their delegates for the congresses of the Leninist Young Communist League of the Soviet Union.

Sixteen pilot-astronauts of the USSR were present at the 16th LYCLSU Congress held in May, 1970. This number included Valerii Bykovskii, the first Leaguer to have visited outer space. For him, for his comrades, the Young Communist League was the starting point of his life.

While travelling in outer space, Bykovskii took with him ten YCL badges. For 119 hours they were on board the "Vostok-5".

According to the decision of the Central Committee of LYCLSU, the space hero gave them to the best examples of Soviet youth. At the time of the solemn ceremony, the astronauts' commander and member of the CC

LYCLSU, Yurii Gagarin was present.

Giving the badge with the inscription "Outer Space. 14-19. VI.63", Valerii Bykovskii wished every Young Communist Leaguer success in life and work. He warmly congratulated the following : Yurii Zhuravlev, the scientist from Siberia; Valerii Brumel', honored Master of Sports of the USSR; Gennadii Uvarovskii, excavator driver of the Bratsk Hydroelectric Station; Kuz'ma Severinov, the Donets miner; Robert Malozemov, the Leningrad milling-machine operator; Nur-Sultan Nazarbekov, fireman of the Karaganda metallurgical factory; and senior sergeant Viktor Subbotin. They all received the badges from the astronaut's hands.

Hailed with special warmth by the astronauts were the girl workers : Naira Gogatadze, the tea grower, Makhbuba Nasreddinova, driver-mechanic of a cotton-picking machine from Uzbekistan, and Lyuba Sysoeva, milkmaid from the environs of Moscow.

The secretary of the CC LYCLSU said that the presentation of YCL "Outer Space" badges to the group of young people for their work on the earth, was a great and happy event.

"Bring more badges from outer space" said the secretary to the astronauts, "and we will find people who deserve to wear them. The number of deserving people is quite big."

"We understand and we shall try!" replied Valerii Bykovskii to the accompaniment of friendly applause.

* * *

Years had passed since the 16th LYCLSU Congress. Valerii wanted to find out how those people to whom he wished success while presenting the badges were getting along. And their affairs were in excellent shape. Here are just three examples.

The mining team of Kuz'ma Severinov dug nine thousand tons of coal over and above the plan during the year 1969. The miners are introducing the latest technology in difficult geological conditions including the first complex KM-97 for small thicknesses of coal vein. Such equipment can completely free the miners from manual labor at the time of excavation, loading and transportation of coal and timbering the coal face. Severinov was twice elected Deputy of the Supreme Soviet of the Ukrainian SSR.

The Georgian tea grower Naira Gogatadze is known not only in her native Makharadzev region, but all over Georgia. Since that memorable day, when Naira got the "YCL Outer Space Badge", she has graduated from a tea-collector to a research scholar of the All-Union Tea and Subtropical Crops Research Institute. Naira finished the Sukhumi Subtropical Institute while continuing her work as agronomist at the collective farm.

Makhbuba Nasreddinova is now an honored machine-operator of the

Uzbekistan SSR, and she fully justifies this title. The award receivers themselves informed Valerii about all this in their letters.

"I have to tell them too, what I have achieved during these years and what events have taken place in my life," said Valerii Bykovskii. "First of all, I graduated from the Zhukovskii Air Force Engineering Academy. The diploma has the words : 'Pilot-Engineer-Astronaut.' I am bringing up two sons. I often meet the workers, particularly the youth and visit different cities. And of course there is my 'outer space work.' Once Sergei Pavlovich answered the question, what is needed for achieving success in outer space, with these words : 'Simply give your whole life to it.' Everyone of us gives his life to the cause of studying outer space ..."

* * *

One day before the start.

... Just now the radio announced, "Valerii Fedorovich Bykovskii was born in 1934 in Pavlov-Posad, a city of Moscow region."

Let us go to the birthplace of Astronaut-5. What do we know about this city situated in the environs of Moscow? We can safely say, almost nothing. In the car we feverishly run through the guide book.

It appears, that Pavlov-Posad (or according to the old days, Volkhonskaya Volost'), is first of all mentioned in the will of Prince Ivan Kalita, about 1339... In 1881 the railway line joining Moscow with Nizhnii Novgorod was laid through Posad. At this time already both small and big textile

factories had been established there. In his work "The Development of Capitalism in Russia" Lenin refers to Pavlov-Posad.

After the Great October Revolution, the city became a textile center. The woolen industry occupies the leading place. Cotton and silk fabrics, hosiery and haberdashery industries are also well established.

The astronaut's father Fedor Fedorovich and mother Klavdiya Ivanovna worked in this city and Valerii was born here.

The day on which we visited Pavlov-Posad, everywhere meetings were going on in connection with Valerii Bykovskii's flight. The Young Communist Leaguers were sending telegrams to the astronaut, "Dear Valerii, fellow-townsman in outer space! Indescribable happiness has overwhelmed us. Congratulations from the bottom of our hearts; shall be happy to meet in Pavlov-Posad."

The city youth was particularly happy that the first Young Communist Leaguer had gone to outer space. In the city committee of LYCLSU the news about accelerated shifts by young patriots in honor of their fellow-townsman kept pouring in.

Before the start of "Vostok-5" Valerii addressed a letter to the people of his age group.

"I am writing these few lines from the cosmodrome awaiting the start. I have been appointed Commander of "Vostok-5". Any man would be happy and proud to have so much confidence placed in him by the people and the party.

"In front of me is a big task. But my dear young friends, I want to share this flight with you. This is our common flight. We have all worked a lot. And now the rocket is standing, the craft is ready, thousands of skillful apparatus are set for the start. I know how much effort was put in by our people, how many young hands have also labored, so that everything would be reliable, so that I can feel easy. Thanks to you I shall feel easy. So thank you, my young friends!

"There will be the YCL badge with me during the flight. This is the badge of our Union of Young Communists. I pin it on my shirt with emotion. It is exactly the same as the one on your shirts—our banner with the silhouette of Lenin. We must all be worthy of his example always. Friends, let us dream, let us dare, and let us do kind deeds on the earth!

"In everyone's life a time comes when he has to make some sort of a start. My hour has come. I request the Young Communist League to have faith in me, as in a faithful son. I shall do everything to increase the fame of our union.

Till we meet friends!"

The astronaut had signed it, "Young Communist Leaguer Valerii Bykovskii."

The secretary of the astronaut branch of the Young Communist League

has described the jovial young Bykovskii, how he studied and mastered the Soviet spacecraft so well, how he got acquainted with the people making "Vostok-5". Valerii, by nature an inquisitive person, was literally interested in everything, not only at the time of his studies, but also while meeting the designers, doctors, engineers, and scientists.

"As secretary of the YCL bureau, I know that since the day Bykovskii received his YCL membership card, he has become a model pupil of our famous Leninist Young Communist League", Valerii's comrade added. "Bykovskii was always among the leaders everywhere, in the military school for pilots, in Kachinsk College, as well as in the military unit of the Moscow area anti-aircraft defense, where he served as an officer.

"In the armed forces unit of anti-aircraft defense, Bykovskii was a member of the bureau of the YCL squadron organization and later of the wing, responsible for mass culture.

'He was at once elected a member of our YCL bureau, and the astronauts made him YCL group organizer. One of his latest YCL commissions was his report 'The Success of Soviet Personnel in Mastering Outer Space.' The armed forces personnel, who listened to Valerii, had no inkling that after some time this very person would 'continue' his lecture, from outer space itself."

The secretary of the YCL bureau continued, "Once I was talking with Valerii just by the way, about the place of man in the life of society. And I asked him what, according to him, is the main trait of a Young Communist Leaguer. Valerii answered :

'Honesty to himself, and to the nation; honesty in fully carrying out one's duty to the motherland; honesty in small matters as well as big; deep dedication to one's affairs, to the party and to communism.' "

And these are not simply words. Valerii Bykovskii is always exacting with himself and with others, for he is a man of principle.

Andriyan Nikolaev recollected how once Bykovskii's name was proposed for the YCL committee. But suddenly Valerii refused to accept the nomination :

"I should not be elected. I am oversensitive to trouble. I become rather harsh."

"We need just such people," decided the Young Communist Leaguers.

Valerii was elected joint secretary of the organization. And German Titov was elected secretary. They worked in unison. They got along well, although both are "rather harsh". They were called, "the fiery leadership."

"Our secretary of the party organization," continued Andriyan Nikolaev, "asked Valerii once : 'When do you propose to join the party?' 'I shall fly as a Young Communist Leaguer' announced Valerii.

"As usual, he decided to take my advice," Andriyan recounted. "I asked him : 'But what do you think yourself?' 'The party needs experienced

And again training. . .
A. Leonov, V. Bykovskii, V. Gorbatko.

people. My time has not come yet.' he said. I did not try to make him change his mind. But I was very pleased at Valerii's strictness."

Getting ready for the outer space flights, Bykovskii underwent training on all the devices purposefully and persistently.

"I went to the centrifuge with a strange feeling," he recalled. "A pilot knows the principle of this original device, and the final result—the load factor. During flights in aircraft, it had happened several times. But how can a definite force of gravity be created on the surface? This centrifuge is a cunning thing. At first I was perturbed, but I tried to brace myself fully. When the stand started working, I calmed down. I bore the first test easily. The doctors decided to increase the load. It became rather hard. I tried to ward off the dimness in the eyes and the leaden heaviness in the whole body by the effort of willpower."

Andriyan Nikolaev supplemented Valerii's story : "In general, it seems he achieves everything quite easily. He bears burdens jokingly without any fuss. When he is being 'gyrated' in the centrifuge he laughs: 'Looks like the speed is catching up with the squeak. Have you oiled the cart?' At such a time it is difficult even to lie down, not to speak of talking. And he is none the worse for it! He would come out of the 'cart', and start joking : 'It was good that I took porridge in the morning, it helped.' Some people look at him and probably think : 'How easily he masters everything. What a lucky person!'

"But let us examine this : is everything really so simple and easy for him? I know that before a test on the centrifuge Valerii would never break the regime for any reason whatsoever. The physical training instructor once remarked just by the way. 'If I were in your place, I would breath with the stomach.' Valerii stuck to the advice. He tried to breath with his stomach and felt a bit lighter; tried again and felt completely well."

Nikolaev recollects another event, connected this time with the heat chamber : "Once we started a competition in the heat chamber. Yes, in a heat chamber, strange as it may seem; and how did it all start? One of our astronauts stayed on longer than necessary in this steam chamber. The doctor knocked : 'Come on out'. 'I shall sit a little longer', the astronaut replied. 'It is bearable.' At last he came out. He was steaming like a boiler! Somebody threw a towel to him."

'Are you trying to set a record?'

'But why not?'the 'champion' smiled. 'Try and sit in as long as me ..... if you have enough spirit.'

"Flaunting and showing off? and thinking 'Look, what a picture of strength, what a Hercules I am ...' 'O.K. We shall see!' said Bykovskii.

"What was it that offended him? Of course, not the 'record', but the comrade's behavior. The 'champion' behaved in a boastful manner. And Valerii cannot bear showing off. The words, 'Try to sit in as long as me'

cut into his heart like a knife. Hence he decided to try. And what do you think? He sat in the heat chamber longer than the 'champion'..."

We may add that Bykovskii was the first to go through the soundproof chamber test. He took with him into the "Chamber of Silence" not only books, but a small box with various instruments also. Valerii contrived trinkets, painted, drew, and when one of the contrivances went out of order, he removed the defect himself. The astronaut, naturally, had other work too : he transmitted data about the temperature of the air, humidity, pressure, etc.

Valerii bore the prolonged loneliness well. He came out of the soundproof chamber the same as he had entered it, cheerful and full of spirits. A small but very important point is that the astronaut himself showed a desire to undergo the test first. And at that time even the experimenters themselves did not know how a man would behave under such conditions.

This was the type of hardening which helped Bykovskii in bearing the difficulties of the flight. He sent warm good wishes to the famous Leninist YCL and to the entire Soviet youth from the spacecraft. The Central Committee of the LYCLSU sent a radio message to the astronaut, that the Soviet youth was proud that a member of the Leninist YCL had gone up to assail outer space in the footsteps of other communists, Yurii Gagarin, German Titov, Andriyan Nikolaev and Pavel Popovich.

From outer space Valerii sent a radiogram to the Central Committee of the CPSU with a request to admit him to the ranks of the party. The Central Committee examined the request and agreed to admit Bykovskii as a member. German Titov gave his friend the good news. Valerii enquired : "So speedily a member of the party?"

Valerii Bykovskii had several meetings with the youth. One everyone particularly remembers. This took place at the plenum of the CC LYCLSU.

The participants of the plenum welcomed Valentina Tereshkova and Valerii Bykovskii with enthusiasm. Stormy applause was intermingled with shouts of "Excellent! Magnificent! Well done!" Everyone shouted : "Valya-Valerii!" Valerii could not start his speech for several minutes. We had never seen such embarrassment, such agitation on his face.

"It was very nice that Valya spoke first today," said the confused astronaut. "Usually, on such occasions, she would say : 'You flew first so let us speak in that order.' Just now Valya said that during the flight she never felt loneliness. I can also say the same thing. There was a feeling that I was not flying alone, but that we were all flying together ..."

During this very plenum Tereshkova and Bykovskii were awarded the diplomas of the Central Committee of the YCL with the badges "For Active Work in the YCL". The resolution of the CC LYCLSU reads : "Valerii and Valentina set an example for millions of young boys and girls by their valor, steadfastness and complete devotion to the Communist Party. The

Serezha Bykovskii was born on Astronautics Day.

Young Communist Leaguers of the country are proud of their feat; they learn from the heroes of outer space how to accomplish difficult tasks."

... Valerii will always remember the day when he received his party membership card. It was on July 11, 1963. The secretary of the party committee read the resolution of the Central Committee of the Communist Party of the Soviet Union.

The solemn moment approached. The senior partyman gave the party membership card to comrade Bykovskii and affectionately kissed the hero. Valerii looked at the red booklet and said :

"I am tremendously proud and happy that I have become a member of our dear Communist Party ... My dream has come true. I am deeply thankful to the Central Committee and to you, dear comrades, for the honor shown to me... As befits a communist I am ready to carry out any new task set by the party and the Soviet Government."

* * *

The reader has the right to ask : and how well does Valerii Bykovskii live up to his words?

We are glad to answer : the same as he has always done. His day is one long round of work and as always, he has lots to do, for Valerii shows the same devotion to whatever task he is called to do. Astronaut Bykovskii is now preparing for new outer space routes.

Valentina Vladimirovna Nikolaeva-Tereshkova,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On June 16, 1963, the "Vostok-6" spacecraft was launched into orbit as a satellite of the earth. For the first time in the world, the pilot was a woman astronaut, Valentina Vladimirovna Tereshkova, a citizen of the Soviet Union.

"Vostok-6"

The title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon Valentina Vladimirovna Tereshkova for making a prolonged flight in outer space in the satellite-spacecraft "Vostok-6".

According to the decision of the Presidium of the Supreme Soviet of the USSR, a bronze bust of the heroine has been installed in the city of Moscow.

* * *

Valentina Vladimirovna Tereshkova is conferred the title of the "Pilot Astronaut of the USSR" for making a prolonged outer space flight in the satellite-spacecraft "Vostok-6".

* * *

FROM THE HEROINE'S LIFE

Valentina Vladimirovna Nikolaeva-Tereshkova was born in 1937 in the village of Maslennikovo, in the Tutaevskii district of Yaroslav region.

She started working at the age of seventeen, first in the Yaroslav tire factory, and later as a spindler in the "Krasnyi Perekop" textile mill, where her mother and elder sister also worked. Valentina finished the working youth school while continuing her work and graduated externally from the textile polytechnic.

At the mill Tereshkova became a member of the Young Communist League. In 1960 the League elected her LYCLSU committee secretary of the "Krasnyi Perekop" mill. Since 1964 Tereshkova has been a party member.

The sport of parachuting attracted Valya very much and helped her in becoming an astronaut. While undergoing training in the astronauts' detachment, she received officer's rank.

Valentina Tereshkova is married to astronaut Andriyan Nikolaev.

V.V. Nikolaeva-Tereshkova graduated from the N.E. Zhukovskii Air Force Engineering Academy. She is a Deputy of the Supreme Soviet of the USSR, President of the Committee of Soviet Women and Vice-President of the International Democratic Federation of Women.

SEA GULL

THERE is no foreign delegation which does not long for a meeting with the woman pilot-astronaut Valentina Vladimirovna Nikolaeva-Tereshkova, Hero of the Soviet Union and President of the Committee of Soviet Women. Often, long hearty conversations and sometimes even fiery discussions take place in her study on Pushkin Street.

...Valentina Vladimirovna receives a women's delegation from one of the Asian countries. Animated conversation ensues.

The phone starts ringing.

"Excuse me, just a minute," says Valentina.

"I'm listening! Yes, it's me. How are your affairs? What are you doing? Is it boring? I shall come soon. Good health. I can't talk for long, I have guests. Well, goodbye. I kiss you."

The people present could guess by Valentina Vladimirovna's happy smile and intonation, that she was talking to her daughter.

"Please tell us, how old is your daughter?" asked one of the visitors.

"Alenka is almost grown up now; she was born in 1964. Her full name is Elena. We gave her this name in honor of my mother."

"And does she resemble you?"

"Alenka is an exact copy of my husband!"

Valentina Vladimirovna takes out a photo of a girl with big eyes and dark hair. The photo is passed from hand to hand. Then the businesslike tone of conversation starts again, but already it has become warmer, and friendlier.

Valentina Vladimirovna sees the delegation off. Now she has to busy herself with current business. She is informed about the preparations for the international symposium : "Lenin on the role of woman in society and the experience of solving the women's question in socialist countries." The symposium was to be conducted by the Committee of Soviet Women.

Nikolaeva-Tereshkova suggests that those cities whose history is connected with Lenin's name should be contacted by telephone. A tour of places associated with Lenin is included in the program of the symposium.

Having bade goodbye to the employees, Valentina Vladimirovna goes home, to the "Star City".

... And tomorrow again innumerable urgent tasks. The affairs of a Deputy are added to her service affairs, because the world's first woman astronaut is also a Deputy of the Supreme Soviet of the USSR.

Tomorrow new meetings and conversations with foreign guests; for women from different countries listen with rapt attention to Nikolaeva-Tereshkova. This happens not only in Moscow, but also on her foreign trips.

And so it was at the World Women's Congress at Helsinki.

Delegates of many women's organizations, as well as UN Agencies, had collected to discuss the "Role of Women in the Modern World."

The Soviet delegation presented a report "Women and Labor". When Valentina Nikolaeva-Tereshkova went up to the rostrum, applause broke out.

"One of the most characteristic features of our time is the growth of labor activities of women in all the countries of the world," Valentina Vladimirovna began. "One third of the material wealth needed by mankind, is produced by women. They contribute a lot to the development of world culture and science. Economic incentives are not the only reasons for women's desire to share the burden of work. More and more women are coming to the conclusion that participation in productive labor is the only way to equal rights both in society and in the family ..."

The heroine of outer space spoke as a leading worker of the International Women's Movement. She expressed the opinion of millions of women workers of the world's first socialistic State.

Another congress, held in Moscow, has left an imprint on our memory. Valya had just returned from her space flight. This was her first such meeting. When the chairman declared that the world's first woman astronaut was

A meeting at the airport.
V.V. Nikolaeva-Tereshkova and Mrs. Indira Gandhi.

present in the Kremlin Palace of Congresses, all the delegates stood up. Valya went up to the rostrum, to the accompaniment of thunderous applause. The leader of the International Democratic Federation of Women, Ezheni Cotton, embraced and kissed her. The representatives of various delegations offered the heroine flowers and presents.

"Later, later . . .", the chairman tried to quieten the hall. "Dear friends, Valya is a delegate of the congress. During the six days every delegation can meet her, talk to her. I now request everyone to sit down. Let us continue with the congress."

How many times the delegates went up to the rostrum, to hand over a present to Valya, to put on her neck a neckerchief or a garland of flowers as a token of their love and special respect. Tereshkova's name was mentioned in every speech. Everyone turned to congratulate her.

The news that Tereshkova would speak at a regular meeting spread

quickly among the delegates and guests. In the hall, with the capacity of 6000 people, not a place was left vacant. An electric atmosphere prevailed in the Soviet and foreign press lounges : all over the world people were eager to hear what the world's first woman astronaut had to say.

Honorary delegate of the congress, Valentina Tereshkova began her address :

"Respected ladies, participants of the congress! Dear friends!

"The Soviet people showed in me, a simple Soviet woman, the highest faith by setting before me the task of flying in outer space. I am very happy that I was able to justify the faith of my people. I can report that the flight program of the 'Vostok-6' spacecraft was fully carried out."

Valya spoke, and it seemed to every delegate as if she was conversing with herself and narrating to herself about the flight.

"My spacecraft," continued Valentina, "completed 48 circuits around the earth and successfully landed in the predetermined region in my native Soviet land, in the Kazakhstan steppe. So great was the exactness of the calculations made by Soviet scientists, so perfect the mechanisms and systems of the spacecraft created by Soviet designers and so skillful the mastery of Soviet engineers, technicians and workers, who produced this wonder of a craft.

"From outer space I sent radiogram greetings to the people of the continents over which 'Vostok-6' flew. Today in person, I again greet heartily and with goodwill all the women of our planet, the representatives of different countries who have collected at their own world forum, in this hall, in my native land, in the capital of my motherland.

"The spacecraft completed one circuit around the earth in 88 minutes. In less than one and a half hours I flew over the continents, over all the countries which have sent their delegates to Moscow for the women's congress. I flew and thought : how nice it would be, if my 'Vostok-6', so to say, a *female spacecraft,* could build a bridge from my heart to the heart of every woman on earth. I looked at our wonderful earth and thought : we must never allow this blue and shining land to become covered with black atomic dust.

"Every 1½ hours the dawn met us. The sun rose in an inimitable gamut of colors. Can we ever allow the mushroom clouds of atomic explosions to eclipse the sun?"

The huge hall was perfectly silent as the delegates listened to the heroine's story.

* * *

Valya was born on March 6, 1937 in a small village, Maslennikovo, near the ancient city of Yaroslavl'. Her parents were collective farmers.

Her father worked as a tractor driver while her mother worked in the collective farm and looked after the household.

Valya's father died for the motherland during the war, so the mother shifted to the city with her two children. The girl went to the seven-year and the evening school for working youth in Yaroslavl' ... In 1954 Tereshkova joined the tire factory assembly shop.

Valentina's mother and sister worked in the "Krasnyi Perekop" textile mill, and soon the girl also changed to that establishment. She strove to master the speciality of spindler, and to acquire secondary technical education, she enrolled herself externally in the light industries polytechnic.

Tereshkova's YCL career started in the "Krasnyi Perekop" mill. Here she was admitted into the Young Communist League, and became secretary of the mill YCL organization. In fact, the way into outer space also started in the mill. While working here, Valya joined the aeroclub and started taking part in the sport of parachuting and became first class in this sport. She heard about the flights of Yurii Gagarin and German Titov with enormous enthusiasm.

"After Yurii Gagarin's flight," recollected Tereshkova, "vague thoughts of trying to connect my fate with study of outer space filled my mind. When German Titov returned from space having repeated the achievement then I was consumed with the desire to become an astronaut. This thought was so strong that it never left me, whatever I was doing."

During those days when the 22nd Congress of the CPSU was in progress, Tereshkova wrote a letter requesting enlistment as an astronaut. She was the first girl to come to the "Star City". People at the mill, her friends in the aeroclub, even the nearest ones, including her mother, did not know where Valya had gone, or what she was supposed to do. All thought she had been selected in the combined team of parachutists and had to undergo prolonged and serious training.

Yurii Gagarin, German Titov, Andriyan Nikolaev, Pavel Popovich, Valerii Bykovskii and other astronauts welcomed her like brothers. But how surprised was Valya when she came to know that although she was the first girl in the detachment, the first letter with the request to send a girl to outer space had been sent by Young Communist Leaguer Ol'ga Vinnitskaya already in 1927. This letter was addressed to the great scientist K.E. Tsiolkovskii.

"Respected Professor!" wrote Ol'ga. "I read in the journal 'Ogonek,' that the German pilot Max Valler is thinking of flying to the moon. It has been my longstanding dream to fly to the moon and because of this I was interested in Jules Verne. Now, having read some of your books I know there is nothing impossible about the flight to the moon, and I am taking the risk of asking you, if you can request Max Valler to take me with him ... Or should I wait till we Russians start flying; somehow with one's own people it is better ..."

Konstantin Eduardovich paid serious attention to the request of the young Soviet patriot. The scientist wrote to Ol'ga Vinnitskaya that he admired her bravery, but that many problems still had to be solved before man could leave for outer space.

Ol'ga Vinnitskaya's dreams were realized by Valentina Tereshkova.

* * *

"When I thought of outer space and of world affairs, then I understood clearly, how privileged it is to be a daughter of the Soviet people, to be a citizen of the Soviet State established by the genius of Lenin, and by the heroic efforts of our people. The Soviet women want peace, their children's happiness and a clear sky over the earth. I believe, I cannot *but* believe, that the forces of peace will win!"

Once we witnessed a press conference, in which Tereshkova was literally bombarded with questions. The foreign journalists could write down the answers given by Tereshkova only with great difficulty.

"Do you think, that a woman of average physical development can become an astronaut?"

"Yes, of course. But an astronaut must have strong, excellent health. A woman can become an astronaut only after she has undergone a special course of training. My friends and I passed through a strict medical selection committee. When we mastered the training program of outer space flight, we had to study not only the theoretical questions, but also the practical courses of controlling the craft. Great attention was paid to the study of rocket and outer space technology.

"We got training in special trainers, sat in the soundproof chamber, had to bear high gravity forces, in short, our organism was prepared for all the outer space factors which could arise during the flight. It should be added that on the earth we bore much higher gravity forces than during the flight.

"Honestly speaking, when an enormous weight presses you, when the body becomes ten times heavier, when it is difficult to raise one's hand, when the face tightens and when the eyes are forcibly closed, it is not at all pleasant. Training—a definite preparation—is essential. At the time of flight this gives good results.

"Since 1958 I was engaged in parachute jumping. I became a pilot only when I started preparations for the outer space flight. We flew in transport and jet planes."

"And what was the most pleasant thing at the time of the space flight?"

"Piloting the spacecraft manually. It is very pleasant to know that the most complex technology is obeying you. The enormous spacecraft reacts to the smallest movement of your hand. That is a great feeling!"

"Did you wonder if you would be given the honor of being the first woman on an outer space flight?"

"All my friends in the detachment of astronauts had good physical and technological training. Every one of them could fly in outer space just like me. But someone had to be the first . . ."

"Were you afraid of anything in particular?"

"There is a Russian proverb : 'If you are afraid of the wolf, don't go to the forest.' What could I have been afraid of? I had absolutely no doubts about the reliability of my craft. The Soviet people had put into it so much of their labor, brains and love. I knew this and could not have had any doubts.".

"Is the space training the same for men and women?"

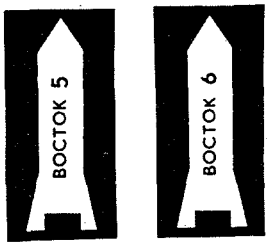
"Outer space does not show chivalrous regard toward women."

"How do you think these flights by astronauts can help toward peace?"

"We support the idea of peace, not war . . . Soviet victories in outer space are the victories of all mankind."

* * *

But how much anxiety there must be in her heart. Where did she find the strength not to betray her alarm, when her husband flew for 18 endless days and nights in the spacecraft "Soyuz-9"? When does she get the time to be a social worker, to look after her children? Yes, Valentina Vladimirovna's earthly "loads" are, perhaps, equal to her space duties.



"HAWK" AND "SEA GULL" IN OUTER SPACE

In the summer of 1963 one more group flight with two spacecraft was made. On June 14, at 1500 hours Valerii Fedorovich Bykovskii left the Baikonur cosmodrome for a 5-day sortie in a near-earth orbit. On June 16, at 1230 hours the spacecraft "Vostok-6" manned by Valentina Vladimirovna Tereshkova, started from the same cosmodrome.

Scientists and designers envisaged further work toward the perfecting of the manned spacecraft's systems, continuation of the study of the effect of the flight factors on a man's organism and his capacity to work. It was possible to make a comparative analysis of the effect of specific conditions of orbital flight on the male and female organism, since a woman astronaut was taking part in the experiment.

Preceding the new flight was a lot of research work on improvements in the conditions of a man's normal vital activity in the spacecraft cabin and a search for better methods of registering physiological functions of the human organism during a prolonged stay in outer space. The designers effected considerable changes in the communication system and in the

arrangements for transmitting television pictures of the astronauts to the earth.

The preparation of a woman for the flight required special scientific research, called forth by the peculiarities of her organism.

The spacecraft "Vostok-5" was launched in an orbit close to the calculated one, with heights : perigee 175 kilometers and apogee 222 kilometers. The heights of the flight of "Vostok-6" at the beginning were as follows : perigee 183 kilometers and apogee 233 kilometers.

The entry of the craft into orbit was borne by both astronauts well and they carried out the planned volume of work. During the first circuit of joint flight, "Vostok-5" and "Vostok-6" came as close as five kilometers to one another.

In accordance with the flight mission, Bykovskii maintained communications with control points on the earth and with "Vostok-6", worked with the apparatus on board, oriented "Vostok-5" in outer space a number of times and tested the system of manual control. At this time he also judged the convenience of the controls, found out how much time was needed for orientation and for stabilizing the craft and whether the spacecraft would easily stay on the oriented position. During the 18th, 34th, 50th and 66th circuits he freely "swam" four times for 1½ hours each time in the cabin, all the while carrying out experiments set by doctors. During this time the astronaut did not notice any unpleasant feelings or violation in function of the organs of vision.

Bykovskii had a good appetite and good sleep throughout the flight. He took food four times in 24 hours. He gave special attention to physical exercises during the flight. At that time a 5-day flight was a record. The physical training exercises helped the astronaut preserve his capacity to work.

V. Tereshkova supervised the working of the systems on board, oriented the craft by using the manual control system, the system regulating the cabin's microclimate and carried out medico-biological and scientific research and experiments while flying in outer space. A lot of time was taken up by radiocommunications with the earth and with "Vostok-5".

The space flight by V. Tereshkova was planned for a day and a night. In view of the satisfactory condition of the astronaut, the duration of the flight of "Vostok-6" was increased to three days. The emotional tension was removed and the capacity to work was restored by sleep during the flight.

The program of scientific investigations to be carried out by "Vostok-5" and "Vostok-6" during flight included taking movie films of the earth's surface, of the cloud cover, the earth's horizon at the time of sunrise and sunset and taking photographs of the moon, sun and stars.

On June 19, after carrying out the research program, the group flight of "Vostok-5" and "Vostok-6" was successfully completed. "Vostok-6"

landed on its 49th circuit, at 1120 hours, 620 kilometers northeast of Karaganda. In its footsteps at 1406 hours during its 82nd circuit "Vostok-5" landed, 540 kilometers northwest of the same city. V. Bykovskii flew for 119 hours 6 minutes. V. Tereshkova's flight lasted 70 hours 50 minutes.

In accordance with the calculations both the craft landed at the same latitude of 53 degrees north.

The astronauts completed the final stage of the flight with the help of parachutes, having ejected themselves from the craft's cabin at the approximate height of seven kilometers.

At the landing sites they were met by the rescue groups, friends, doctors and journalists. The doctors found the astronauts healthy.

The flights of "Vostok-5" and "Vostok-6" contributed a lot to the further development of astronautics. The 5-day stay by Bykovskii under conditions of weightlessness testified to the safety of a prolonged stay by man in outer space. Tereshkova's flight helped in drawing the conclusion that a properly trained female organism can undertake outer space flights.

The outer space experiment, carried out on two spacecraft-satellites, once again demonstrated the possibility of fulfilling an important operation for astronautics, that of docking in orbit. It permitted the collection of experience for carrying out complex flights with the participation of several spacecraft.

The flights of "Vostok-5" and "Vostok-6" were the concluding flights in the series of experiments conducted by the scientists and designers on the "Vostok" type spacecraft. During these investigations, important data about the working of the design and the systems of this first rocket-flying device, about the behavior of man and the reaction of his organism to the conditions of outer space flight were collected. A considerable volume of research was fulfilled and the system of preparation and training of astronauts was worked out and tested.

The positive results of the "Vostok" flights permitted the start of a new stage in the conquest of outer space : the flights of the multiseater spacecraft-satellite "Voskhod".

Vladimir Mikhailovich Komarov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On October 12, 1964, in the Soviet Union, the world's first three-seater manned spacecraft "Voskhod" was put into orbit as a satellite of the earth by using a new mighty launch rocket.

The crew, consisting of the following citizens of the Soviet Union, was on board the spacecraft: craft commander Pilot-Astronaut, Engineer-Colonel Vladimir Mikhailovich Komarov, and crew members Scientific Worker-Astronaut Konstantin Petrovich Feoktistov, Kandidat of Technological Sciences and Physician-Astronaut Boris Borisovich Egorov.

"Voskhod"

For making a flight in outer space in the multiseater satellite-spacecraft "Voskhod", the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Vladimir Mikhailovich Komarov.

* * *

The title of the "Pilot-Astronaut of the USSR" is conferred upon Vladimir Mikhailovich Komarov, a citizen of the Soviet Union, for making an outer space flight in the multiseater satellite-spacecraft "Voskhod".

* * *

FROM THE HERO'S LIFE

Vladimir Mikhailovich Komarov was born in 1927 in Moscow.

Since childhood he dreamed of becoming a pilot. In 1942 he joined the Air Force Special Training School in Moscow, which he finished with excellent grading. After that he studied in the Bataisk and Borisoglebsk Air Force Schools for pilots. Since 1949 he served in various military units.

The Command gave good references about Vladimir Mikhailovich. It noted that he flew with guts and self-confidence, did not lose his head in complicated situations and took decisions quickly. He was given the rank of "Air Force Pilot, Third Class."

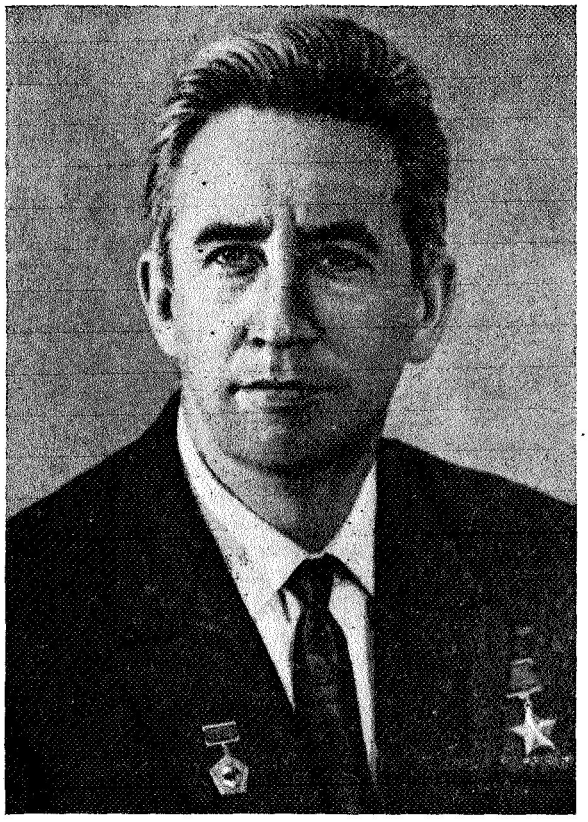
V.M. Komarov joined the CPSU in 1952.

In 1954 Komarov became a student of the N.E. Zhukovskii Air Force Engineering Academy. In 1959 Vladimir Mikhailovich graduated from the Academy and was made an Adjutant.

In 1960 the pilot-engineer was given the rank of Air Force Paratroop Instructor.

He was awarded the Order of the Red Star and the following medals: "For Service in Battle", "30 Years Service in the Soviet Army and Navy", "40 Years Service in the USSR Armed Forces", and "For Irreproachable Service."

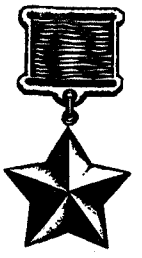
1961—1971



Konstantin Petrovich Feoktistov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

The "Voskhod" spacecraft has completed its fifteenth orbit around the earth. Craft commander, Astronaut Komarov looked after the working of the apparatus and carried out tests on the systems of control and orientation. Scientific Worker-Astronaut Feoktistov took photographs of the horizon and determined the capacity to work with the help of tables during the 15th circuit of the flight...



"Voskhod"

For making a flight in outer space in the multiseater satellite-spacecraft "Voskhod", the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Konstantin Petrovich Feoktistov, Kandidat of Technological Sciences.

* * *

The title of the "Pilot-Astronaut of the USSR" is conferred upon Konstantin Petrovich Feoktistov, a citizen of the Soviet Union for making an outer space flight in the multiseater satellite-spacecraft "Voskhod".

* * *

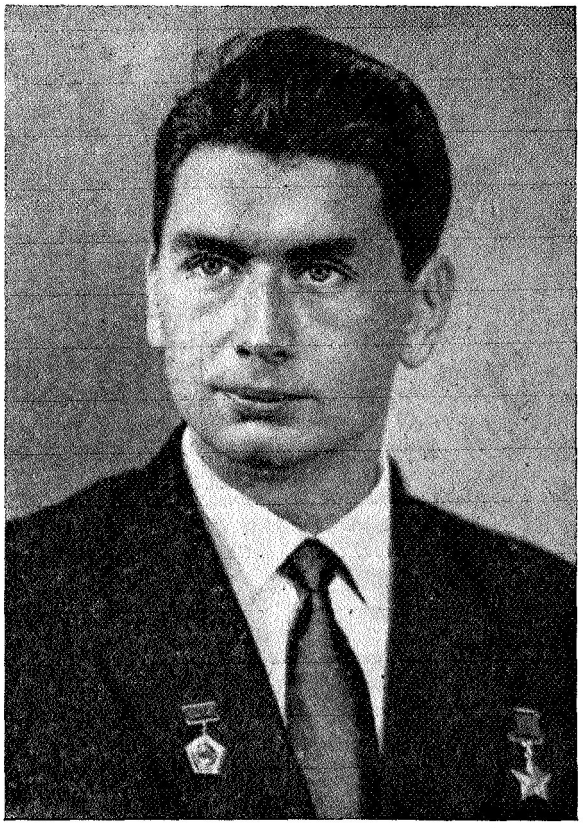
FROM THE HERO'S LIFE

Konstantin Petrovich Feoktistov was born in 1926 in Voronezh.

At the age of sixteen he went to the Front, where he was a scout in one of the military units. He was wounded in 1942, but completed his high school after the injury, and in 1943 passed the entrance examination of the Bauman Higher Technical School in Moscow.

After becoming an engineer he worked in research institutions. Konstantin Petrovich proved to be a good specialist, having wide technical knowledge. In 1955 he was awarded the Degree of Kandidat of Technological Sciences and after his flight in the spacecraft "Voskhod" the Degree of Doctor of Technological Sciences.

K.P. Feoktistov has been twice awarded the Order of Labor Red Banner for his success in the development of Soviet science and technology.



Boris Borisovich Egorov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On October 13, 1964 the three-seater spacecraft "Voskhod" successfully completed the program of scientific investigations and landed safely in the predetermined location... Valuable material about the flight of a group of astronauts, consisting of various specialists has been collected.

"Voskhod"

For making a flight in outer space in the multiseater satellite-spacecraft "Voskhod", the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Physician Boris Borisovich Egorov.

* * *

The title of the "Pilot-Astronaut of the USSR" is conferred upon Boris Borisovich Egorov, a citizen of the Soviet Union, for making an outer space flight in the multiseater satellite-spacecraft "Voskhod".

* * *

FROM THE HERO'S LIFE

Boris Borisovich Egorov was born in 1937 in Moscow. He joined the Moscow Medical Institute in 1955. In the Institute he was attracted toward scientific work, particularly toward questions of aviation medicine.

After graduation from the Institute in 1961, the young physician worked in a number of medical research institutions. His scientific papers have been published in specialist periodicals. He was awarded the medal "For Excellent Service to Health."

B.B. Egorov went to the "Star City" for a course of special training.

After his flight in the spacecraft "Voskhod," Boris Borisovich defended his thesis for the Degree of Kandidat of Medical Sciences.

OUTER SPACE CREW

COMMANDER

BAIKONUR. The last evening before "Voskhod's" flight. The moon was shining in the starry sky. Two people were walking on the sandy path near the astronaut's little house. They were Academician Sergei Pavlovich Korolev and "Voskhod" commander Vladimir Mikhailovich Komarov. Searching the sky, both kept quiet. Each engrossed in his own thoughts. The scientist started the conversation.

"There, Volodya... Your turn has also come. I wish you a good journey."

"Thank you, Sergei Pavlovich."

The friendly words of the spacecraft designer touched the astronaut, since they came from the depths of his heart. The Academician had called him Volodya for the first time.

Wishing him goodnight, the scientist went back to the house.

Komarov followed the Academician with his eyes for a long time. He recalled his first meeting with this man...

"Can you imagine what our feelings were," related Vladimir Mikhailovich, "when we, the young pilots, came to know that the very scientist who was the genius behind the group making the spacecraft and rockets, was coming to see us...

"And then Sergei Pavlovich entered. He interrogated each one of us in detail—where we had studied, whether we had a family, and other questions too. The conversation was intimate, exciting even.

"My turn came. We started talking, and suddenly Sergei Pavlovich said: 'Well, you engineer-captain, you have to become the commander of a multiseater craft'...

Time passed and now at last Vladimir Mikhailovich was leading the first outer space crew. Tomorrow, October 12, together with scientific worker Konstantin Petrovich Feoktistov and doctor Boris Borisovich Egorov, he would go into outer space.

* * *

How did the astronaut's life take shape, what landmarks can be noted on his journey into aviation and to outer space?

The brightest reminiscences of Volodya's childhood are connected with the Chelyuskin epic, the nonstop flights to the Soviet Far East and later to America via the North Pole, by Chkalov, Baidukov and Belyakov. After the Chkalov trio, Gromov, Yumashev and Danilin also strived to fly along the Moscow-North Pole-USA route.

Komarov and his friends, staying on Third Meshchanskaya Street, were agitated and perturbed when "Chelyuskin" sank, while passing through the Arctic ice. The crew and the participants of the expedition disembarked on the ice. The whole world was interested in the life of the "Shmidt camp." The tent township was named this way after the surname of the leader of the expedition Otto Yul'evich Shmidt. The boys enthusiastically received the information about the valorous flights of Lyapidevskii, Vodop'yanov, Doronin, Kaminin, Levanevskii, Molokov and Slepnev. These pilots brought out all the Chelyuskiners and became the first Heroes of the Soviet Union.

Volodya ran to Gor'kii Street to see the Chelyuskiners and the pilots go to the Red Square. He applauded Chkalov, Gromov and members of their crews. Then there was the winter stay by Papinin, Shirshov, Krenkel' and Fedorov on the drifting station "Severnyi Polyus" and another triumphant meeting in Moscow.

These heroic flights and the exploits of Arctic explorers left a deep mark in the boy's consciousness. He wanted very much to be like those whose names were spoken with pride by the Soviet people.

Volodya studied diligently. He willingly helped his father, who worked

as a yard-keeper; he swept the sidewalk, and during winter cleared the snow and chipped off the ice.

The war brought in its wake many ordeals for the Komarovs. The father was called to the army while mother and son lived on scanty rations.

During those days, Viktor Talalikhin rammed a Nazi aircraft on the approaches to Moscow and the enemy plane was put on review right in the center of Moscow, in Sverdlov Square. Vladimir finally decided that he would become a pilot.

The Air Force Special Training School, which Komarov joined, brought him nearer his aim. Soon the school was evacuated to Siberia.

"I was short-statured," recollected V.M. Komarov, "and the neighbors, who had come to the station to see me off, laughed on seeing how I marched alone in the last file and remarked: were you carrying your big trunk, or was the trunk carrying you!"

Vladimir was fortunate to be in Moscow on Victory Day: in 1944 the school returned from the Tyumen region. The young man went to the Red Square and there he was caught in the rejoicing crowd. At that time all the service personnel were being mobbed and stormily congratulated, and Volodya was in military uniform. Try as he might, he could not convince the people surrounding him that he had not fought but was still undergoing training, but nobody listened to him.

After the special school Vladimir Komarov joined the Preliminary Aviation Training School. Also the Bataisk and Borisoglebsk Air Force Schools. Finally the day came when Vladimir Mikhailovich became a fighter-pilot. He served in North Caucasus and in Prikarpat'e. The desire to become a flight engineer led Komarov to the N.E. Zhukovskii Air Force Engineering Academy.

Komarov had an excellent record at the Academy and selected a very difficult topic for his diploma thesis. The student before him who had tried to solve this problem was unsuccessful. As the tutor for the diploma thesis said, Komarov had to study modern aircraft and their instruments and show himself as a technologically broadminded person with encyclopedic knowledge. Vladimir Mikhailovich brilliantly proved that he possessed all these qualities.

V.M. Komarov joined the astronauts' detachment in 1960, having behind him not only the Academy, but also working experience as an assistant to a leading engineer-test pilot of one of the units.

The astronaut related, "I had to study supplementary theory and undergo special training. I understood the theory easily, I could get along with the physical training exercises on special contrivances also comparatively easily, since I had always systematically taken part in sport."

... The heat chamber, the soundproof chamber, the pressure chamber, various trainers, "flight" in the spacecraft simulator. This did not exhaust

Sergei Pavlovich Korolev and the first space crew.

the program. The vestibular training took much time. But the centrifuge seemed to be the most difficult nut to crack. "The Devil's Mill", as it was called by Andriyan Nikolaev, shook Komarov pretty much. But gradually the organism got accustomed to high gravity forces, the unpleasant feelings became a thing of the past, and only the record of them remained with the doctors.

Not everyone has the capacity to bear the strain of outer space flight. It is difficult to enumerate all the demands made by such a flight on the astronaut; and still more difficult to find the person suitable for such a flight...

Once Vladimir Mikhailovich fell ill. The doctors thought he would be unable to work normally for six months. Since he would be left behind the question of his discharge arose. But Komarov could not think of living without the challenge for which his soul was crying. He could not part with comrades who were so dear to him.

"I think I will have enough energy to catch up with my comrades and become a full-fledged astronaut," he announced firmly. "And for the time being I shall study the theory and help others..."

Komarov's arguments were reinforced by the astronauts, who unanimously announced. "Volodya is a very valuable person for us!"

Later training showed that the astronaut's organism bore high loads very

well. You cannot find one person in the detachment who lacks a feeling of special warmth for Komarov.

This is how Yurii Gagarin remembered their first meeting:

"I got acquainted with Vladimir Komarov when I came to the hospital, where the health of the future astronauts was being checked. I remember I was sitting with Popovich in a room waiting to be called. One more pilot entered. He was noticeably older than us. At that time we were still not aware of what we were to do but we understood that young people were being recruited. This man was wearing the medal of the Air Force Engineering Academy.

"I asked him:

'In what connection have you come?'

'Well, some incomprehensible summer work is being proposed... But I did not make enquiries, I agreed at once.' "

It was more difficult for Komarov to undergo training, than for the younger men. But at the time of theoretical classes he felt himself in his own element. Vladimir helped everyone willingly, he had the gift of teaching and could explain the most complex things simply and with clarity...

Yurii Alekseevich Gagarin once showed us V.M. Komarov's personal file. Various stages of the pilot's life are reflected in the documents.

1946: "... He is a model in his studies and discipline: calm, steadfast and energetic...group YCL organizer of the platoon, member of the company bureau..."

1949: "...Flies excellently; brave and confident..."

1953: "He deserves to be sent for study to a higher educational institution..."

1959: "Worked on the current material for study assiduously and systematically. He is notable for his punctuality in carrying out the given tasks..."

1962: "...Can serve as an example for others... He has acquired well-merited businesslike authority among his comrades..."

"The last note is written in my hand," said Yurii Gagarin.

"I signed this document. I signed with confidence, knowing that Volodya is exactly like this. At that time Komarov had started intensive training as Popovich's double. The nomination as double means a lot for us, the astronauts. This is first of all an admission of the fact that you are fully and absolutely ready for the flight..."

The resolute character of Vladimir Mikhailovich played its role in the formation of the crew of "Voskhod" and in its flight as well. Such a crew was assembled for the first time. Three people went through a serious examination. They had to start for outer space together, together pass a definite time there, carry out innumerable observations together... When mountaineers want to form a group for a difficult climb, they first of all go for a little climb together. This is a climb for becoming intimate. Its main aim is to

find out how every member of the group behaves in relation to the collective.

Komarov also took great care of his crew members. It was pleasing to note that they understood one another well. The friendship grew, the different characters fitted in. Later the commander wrote that since one individual's behavior affected the others, everyone should learn to restrain himself while they were still on the ground. This was the result of their great respect for one another. Outer space does not tolerate unbalanced people. Persistent understanding of psychology, self control and the feeling of self possession was needed in small as well as big matters from the beginning.

"It was not without significance that we took with us on the flight Andriyan Nikolaev's motto 'the main thing is calmness' and followed it invariably," said Vladimir Mikhailovich after returning to the earth.

It was pleasing to see the three friends at the Vnukovo Airport, Vladimir Komarov, Konstantin Feoktistov and Boris Egorov climbing down the ladder to report the accomplishment of their mission. The commander announced clearly:

"I report to the Leninist Central Committee of the Communist Party of the Soviet Union, to the Presidium of the Supreme Soviet of the USSR, to the Council of Ministers of the USSR: The crew of the spacecraft 'Voskhod' fulfilled the task set by the Central Committee of the Communist Party and the Soviet Government. The flight has been successfully completed. The members of the crew are feeling excellent. We are ready to fulfill any new tasks for the party and the Government."

We journalists had a long conversation with Komarov before "Voskhod's" flight. Vladimir Mikhailovich animatedly shared with us his thoughts.

"In simple words, my heart is jumping with delight, I feel that I am as happy as never before. What other thoughts are there? About the genius Tsiolkovskii, about our scientists, who are carrying forward his work. I am happy that I am in the Leninist party, that I am a son of the nation which first 'opened' the window into outer space, and started its research. Tsiolkovskii bequeathed all his works on astronautics to the Leninist party. Is not this wonderful? Konstantin Eduardovich was confident that only the party could use these works for the good of the people."

The astronaut took with him on board the craft a portrait of Lenin painted in the permanent colors of molybdenum. The commander of the world's first space crew, Vladimir Komarov completed his first flight with Lenin in his heart and with the dream of placing outer space in the service of the people.

A DESIGNER BY BENT OF MIND

The lift took us up to the top of the space rocket. In front, a few meters of metallic ladder leading to the small platform near the craft "Voskhod".

But before going up there, we are waiting for Vladimir Komarov and Konstantin Feoktistov to complete their job, for the platform is a small one.

We look down. The concrete slabs of the launch pad remind one of squares on a chess board and the people below of moving dots; the cars look slightly bigger than matchboxes. It seems as if you can feel the rocket breathe. We are allowed to touch its smooth, cold surface. Here and there on the rocket red ribbons are hanging like decorations on a Christmas tree. These ribbons indicate that such and such system or unit is yet to be checked. And if the red bunting is peeping out from the overalls' pocket of the starting team worker, it means everything is checked and found in order.

Standing here, one feels the chill, and we start stamping our feet to avoid getting frozen. All round us is the endless steppe painted in the gay fall colors.

We had to wait about fifteen mintues. At first Vladimir Komarov came down, saw us and cracked a joke:

"Hurrying to outer space?"

"Well, some day our turn will also come!"

The astronaut entered the lift, pressed a button and the lift disappeared. We went up the ladder to the platform. Yurii Gagarin was standing there. Konstantin Feoktistov was still in the cabin of the craft. It seemed that the astronaut was not surprised at our appearance there, but the eyes of the scientist had a puzzled look.

"Are we disturbing you?"

Either Konstantin Petrovich did not hear these words, or he had no time to answer—he was engaged in checking the systems. It was possible to excuse him: tomorrow "Voskhod" was to be launched.

All the same we had a look at the cabin. The clinical whiteness of the spherical walls of the craft; a small control panel with many tumbler switches, somewhat similar to the aviation ones, attracted our attention. A small globe. The crew can determine at any time with its help, the region of the planet over which "Voskhod" is flying. All the while Feoktistov was speaking in a soft voice with the control point.

"And where is the lid?" we asked Yurii Gagarin, who was looking at us with a smile. "What is this manhole battened down with?"

"Not a manhole, but a porthole," corrected the astronaut. "The porthole lid is here," and he showed us a disk packed in a synthetic wrapper.

Konstantin Petrovich came out of the cabin: "Have some training. Maybe next time we will include you in the crew."

"Thanks, we start training right from this very evening! Can we put a few questions?"

"I'm in a hurry. Yurii Alekseevich will tell you everything. He knows the craft thoroughly."

Feoktistov started going down and in a second he had entered the lift.

Gagarin saw off Feoktistov with a kind look:

"Meticulous. A real scientist. Konstantin Petrovich is intellect and warm heart combined with a designer's talent. He himself has checked everything in the cabin."

* * *

K.P. Feoktistov is a pupil of Academician S.P. Korolev. He and Sergei Pavlovich graduated from one and the same educational institution, the Bauman Higher Technical School. Their portraits hang side by side in the school museum. It seems to us that as human beings they have much in common. But the main similarity is the consuming interest they show for their chosen task, the clarity of purpose coupled with the desire to give oneself completely to astronautics. The Academician thought very highly of his young colleague. He supported the candidature of Feoktistov, when the State committee was deciding the composition of the crew. The designer of the rocket-space system wanted to get a scientist's evaluation of outer space technology and its behavior under conditions of flight.

At the time of our first meeting at the cosmodrome we asked Feoktistov what had influenced his selection of this profession. He replied:

"The works of Tsiolkovskii. I read them with interest, then started thinking very often, how can I further the development of these ideas? This beloved scientist's wonderful capacity to look far ahead, amazed me. He foretold how the forces of earth's gravity could be overcome. The practical advice of the scholar startles us to this day by its originality and perspicacity."

"When did you finally decide to study for the conquest of outer space?"

"This happened when I was already in the Moscow Higher Technical School. There I heard the lectures and conversed with Sergei Pavlovich Korolev. I knew him for a number of years. The overpowering impression the Academician leaves on you is his enormous energy, which seems to infect all the people around him. He is very decisive and often stern. He combines exact calculation with energy and vision."

"And when did the thought about outer space flight come to your mind?"

"I made a number of requests but was not accepted. I wanted to verify my assumptions by concrete observations. I wished to establish the virtues and defects of the 'Voskhod' systems on the spot."

This reveals the *real* Feoktistov: "designer by vocation, designer by talent and designer by bent of mind," as he was characterized by Aleksei Leonov.

The second meeting with K.P. Feoktistov also took place at Baikonur, but after the flight. During those days the whole world talked about the flight of the "Voskhod" because this was, in fact, the first multiseater craft carrying the first scientific expedition, consisting of an engineer, a scientist and a physician working on board the spacecraft. The National Academy

K.P. Feoktistov after a training flight.

of Sciences of the USA wrote congratulating Soviet scientists: "The successful launching of the spacecraft with a three-member crew is the beginning of a new era in the exploration of outer space."

Everyone waited for the astronauts to describe their flight and the research they had been able to carry out during the 24 hours.

We all collected after the flight in the small hall of the hotel, where the astronauts live. After their thorough medical examination we heard K.P. Feoktistov's account.

"From the height of four hundred kilometers our earth is really very beautiful. The air crown around the earth is wonderful. There is an amazing gamut of colors in the outer space landscape. Against the background of the dark, completely dark sky, the Great Bear, Orion, Pegasus and Cetus constellations shine brightly, like diamonds. And the sun? If all the people on the earth could see it rise and set the way we did, how they would love the heavenly body! The sun would appear from behind the horizon very suddenly, at first as a bright reddish line. Because of our high speed of approach, it would grow in front of our eyes instantaneously. At first we saw a greatly stretched oval figure and then the sun became a huge, round disk and it would dazzle the eyes in such a way that it was impossible to look at it. And the Aurora Borealis? Just imagine to yourself the vast Antarctic region with a multicolored curtain rolled out along the whole horizon."

Konstantin Petrovich added that probably an artist or a man of letters could have described the scene more vividly, since writing was not his profession. Next he started talking about the craft.

"First of all the spacecraft 'Voskhod' is a more complex machine, more reliable and adapted for the work of a scientific expedition than the earlier types. We carried out astronomical and geophysical observations, as well as scientific experiments, which would not have been possible on the 'Vostok'. These are essential for the solution of new problems of outer space science and technology, and are connected in particular with the testing of new craft. The day is not far off when new types will replace 'Voskhod'. I think that all the advantages of the earlier models will be included in them. Additions will be made according to the demands of further problems of outer space exploration. Our suggestions, born as a result of our 'Voskhod' flight will also be taken into consideration. I am a strong supporter of the idea that in future expeditions to near-earth outer space, preference should be given to specialists; they can help in the development and perfecting of new, more sophisticated spacecraft."

* * *

...Several years have passed since the first meeting with Konstantin

Petrovich. During these years he has contributed a lot to the development of astronautics, and has enriched it with much theory; in return, he has received the Degree of Doctor of Technological Sciences. The grayness of hair has increased, but in the gray eyes, surrounded by a web of wrinkles there is the twinkle of the same vital thought.

Another meeting took place. The scientist's words were flowing softly, even monotonously, but they had that conviction which wins the hearts of the listeners. Konstantin Petrovich spoke about the possibility of flying to Mars. He spoke so convincingly as if the Mars craft was already standing on the launch pad.

Here is a short recording of his talk.

"...One of these days the launch rocket will take the crew to the interplanetary craft assembled in a near-earth orbit. The journey of the interplanetary craft to Mars will continue for several months. After the craft joins the orbit of the Mars satellite, a planet compartment will separate from it, which will start descending to the surface of the heavenly body.

"What about the return to the earth? The problem of starting from the planet for the main block of the interplanetary craft is in general already resolved. The experience gained at the time of man's flights to the moon, has convinced us about the correctness of the chosen path. Apparently, this experience will be used at the time of Mars flights also. But it seems, that unlike the Moon, it will be impossible to start for the earth just at any time. It will be necessary to wait for the propitious reciprocal position of Mars and Earth. And this time is equal to about $1\frac{1}{2}$ years.

"Thus, a few months of flight to Mars, about $1\frac{1}{2}$ years wait for the propitious moment for the start of the return journey, and a few months for reaching the earth. All this will come to approximately 2–3 years. Three years of life and work in outer space!

"Let us leave the purely technological questions connected with the flight: the start, control and landing on Mars and the return to the earth. Let us touch on only one aspect, that of crew safety during the whole expedition.

"If a group of ten people was to go on board the interplanetary craft on a flight to Mars, it would have to take food, water and oxygen weighing in all about seventy tons. For practical reasons, this is impossible. There is another way: to start on the craft the recycling of substances, that is the development of systems with which it would be possible to completely reproduce food, water and oxygen. In short, the craft should be a small portion of the earth, created by man's intelligence.

"Let us dwell on one more problem... This is a dream as well as a scientific hypothesis. At present the rocket-outer space system, from start till its return to the earth, undergoes considerable changes at the time of flight. During launching into orbit as an earth satellite, various stages of the launch rocket successively separate one after the other. Even after the craft has finished its

work, this is not the last 'loss'. At the end of the flight, while returning to earth, before the craft enters the thick layers of the atmosphere, the instrument section separates from it. Only the cabin with the crew (the recovery capsule) reaches the earth. Thus, if a system with an approximate weight of a hundred tons leaves the surface of the earth, only one ton returns back. The ratio is 1 : 100. But for the Mars craft, if rockets with chemical fuel are used, this ratio may rise to 1 : 10,000.

"But can such a craft be developed, which would be capable of starting directly from the earth, fly along the calculated trajectory to the planet, make a landing on its surface, and then return to the earth without throwing away any of its parts on the way? Can such a craft be produced, which can be used several times, maybe, with the necessary refueling and inspection before each new start? Scientists and designers are thinking about similar problems. In my opinion, two methods are possible here.

"The first one is the creation of orbital craft, intended for orbital flights around the planet and flying over from one orbit to the other. Such craft must be fitted with electrostatic rocket engines (plasma or ion) with a very high specific traction. Their engines will possibly use nuclear reactors as the source of energy, though the use of solar thermogenerators with huge surfaces is also conceivable.

"The second way is to create spacecraft which change very little during the flight, from the start on the earth to their return. They may be constructed with nuclear reactors forming the base (if production of nuclear rocket engines is feasible) which can use the full power of the reactors on board, at those critical portions of the flight where high traction is needed (flight from the surface of a planet)."

...The scientist's words sounded firm and confident. It seemed that this idea was not a dream for him, but a concrete aim, which would sooner or later be embodied in a real interplanetary craft.

BORIS EGOROV SPEAKS

"Name at least three main medical problems which, in your opinion, are important for the attention of the physicians of the world." The French journal "Candid" put this question to astronaut Egorov.

The astronaut was lost in thought for a moment, slightly screwing his big bright eyes:

"First—radio means must be found for treating cardio-vascular diseases. Second—discovery of the secret of cancer's origin. And third, eradication of influenza, which makes millions of people suffer."

"Have you made any, albeit very small, contribution to the solution of any of these problems?"

"Your question is premature. My medical experience is of only a few

years. But in spite of this I hope the journey in the outer space laboratory gives me the possibility of explaining certain aspects of the activities of the cardio-vascular system, the central nervous system and the digestion of substances. I shall be very happy if my observations prove helpful to the world of medicine in any way."

. . . According to his own story, the beginning of the outer space era found medical institute student Boris Egorov working on a collective farm. The students were helping to harvest the potato crop. It was an ordinary day. But this cloudy day in October, as the first artificial satellite of the earth went into orbit, left an imprint in his memory and forced him to think about the future.

"The work of treating people did not attract me very much," the astronaut recollected, "I wanted to dedicate myself to research. Physiology and psychology interested me. When I was still a student I visited scholars and research institutes. I looked around. They always welcomed me with kindness because among physicians very few people want to go in for theoretical work, or research in physiology.

"Once in a bookshop on Pirogovskaya Street, I found the book 'The Psychology of Man in an Aircraft' by the famous scientist in the field of aviation and space-medicine, Grotewohl. It is difficult to say now what exactly attracted me in this book. Perhaps, the illustrations. Supersonic aircraft and special pressurized suits were shown in the pictures. I read Grotewohl's book with interest, then found others on the same topic. I had a great desire to find out in detail, what exactly space medicine was like.

"I started visiting institutes engaged in the production of medical apparatus. I even worked in one of them, since I had an interest in technology right from childhood.

"It was my good luck that I got acquainted with the famous psychologist Fedor Dmitrievich Gorlov, a very interesting man. He started asking me what I knew, what I had read, and then invited me to come to his place of work. The scientist met me warmly and acquainted me with some of his co-workers.

'Let us go. Now I will show you something.'

"We went to a small psychological laboratory, which was working under his guidance. There were tape-recorders and apparatus unfamiliar to me. On the walls there were incomprehensible tables.

'Now you will see a curious thing,' said Fedor Dmitrievich, laughing. 'We will test the psychological state of a man.'

"The scholar directed my attention to Whatman paper, divided into squares. In the squares there were figures from 1 to 25 put in two rows, apparently without any order. The figures were both black and red in color.

"The professor explained, 'The person under test is supposed to quickly show with the pointer and call out the figure. It goes like this.' Fedor Dmitrievich showed with the pointer and said, '1-black, 25-red, 2-black,

24-red...' Suddenly while the counting is on : 20-black, 13-red... the tape-recorder is put on, and a man's voice starts calling different figures, trying to confuse the person being tested. The latter must not get lost and must continue to call out correctly, and also show the figures in accordance with the set task. Thus a man's capacity to concentrate is tested.

"Explaining everything to me, Fedor Dmitrievich requested the waiting pilot to enter the laboratory. His resolute face with manly features and soft smile at once stuck in my memory. The pilot sat and started working on the table. I saw his great tension, how he tried to complete the difficult exercise accurately. The pilot reached the end without making a single mistake.

"It so happened that I had witnessed a candidate for the first detachment of astronauts, which was undergoing the test that day. The man I had seen was none other than Vladimir Komarov. Thus fate brought me in contact with my future commander, the commander of the first three-seater spacecraft 'Voskhod'.

'Finish the institute,' Gorlov said at the end, 'then we will take you unless, of course, you do change your mind.'

"After about two months suddenly there was an unexpected phone call. It was from the laboratory.

"I heard: 'Could you come over, I would like to speak to you?'

"It appeared that at that moment, the formation of the first group of pilots for conducting outer space experiments was going on. They had to undergo serious tests on the earth. In particular, every one of the pilots had to pass 15 days in the soundproof chamber in complete solitude. This was quite a difficult thing. Medical personnel was needed.

"The leader of the group Nikolai Nikolaevich Gurovskii asked after the conversation:

'Do you want to work with us? You will have to specialize.' And at once he cautioned: 'You have to work evenings and night shift. On Sundays and holidays too.'

"Thus I became a worker in the psychology laboratory and was thoroughly happy.

"And here I am on duty at the soundproof chamber. I look after the condition of the unusual patients. I remember, how Pavel Popovich sang Ukrainian songs, how German Titov recited Pushkin's poems, how Aleksei Leonov showed me his drawings through the glass. During those duty shifts of mine I finally decided: space-medicine is the thing—I must dedicate my life to it. During my sixth year in the institute I was appointed junior scientific worker of the research section. This was already a new, more responsible job. I was asked to study physiological problems. Since that day neurophysiology has become the object of my constant study.

"The idea of going into outer space was born automatically. Almost

everyone working in the research institute, and especially those connected with the actual problems of astronautics had a desire to go and visit outer space itself.

"And I was again lucky. April 12, 1961, the launching date of the first manned 'Vostok' was getting near. Doctors, capable of jumping with parachutes, were needed in the eventuality of the astronaut requiring help after his return to the earth. Well, the affair was an absolutely new one. No one knew definitely how the human organism would bear the unusual flight conditions. Hence rescue groups, in which doctors were also included, were posted at various points along the part of Gagarin's flight route which passed through Soviet territory. They were put on board aircraft, and if necessary they had to be ready to jump with parachutes to the astronaut's landing site and give him, if necessary, the needed help, or simply meet him. I was on duty in one of these aircraft. By this time I had learned to parachute.

"But everything was all right. The 'Vostok' landed in the predetermined region with Yurii Gagarin feeling extremely well.

"During that 'Gagarin Spring' of 1961, I graduated from the institute. The desire to become an astronaut was overpowering. Nikolai Nikolaevich Gurovskii answered my frequent requests:

'We will think it over. Of course, physician-research workers will be needed on the craft.' And added, 'I shall keep you in mind.'

"At last I was asked to join the detachment of astronauts. It seemed then, that, after six months I would definitely fly. But it was not to be. I continued my work, participating in the preparation of pilots for the flights. But then my chance came. A physician-research worker was needed in the crew. And I was one of the candidates. Along with my double I successfully passed the medical commission. The training for the flight was going on according to a shortened program. In fact, the volume had not changed, but everything was being done in a shorter period. The training was really meant to give great firmness. We had tested everything except the soundproof chamber. But we had no fear of loneliness because the crew consisted of three people.

"The flight program was rehearsed in the craft simulator. We spent exactly as much time as was needed to complete our work in outer space. It was during these very days that Vladimir Mikhailovich Komarov and I recalled our first meeting.

"October 1965 came. We flew to the cosmodrome. We got acquainted with the rocket which would take our craft into outer space. It made a great impression on me. The main thing was the excitement; even my fears vanished completely after seeing the rocket. I had a desire to fly as early as possible. We, the whole crew, went to the 'Voskhod' and together sat in it. It was just like the simulator. Then we recapitulated the separate elements of the flight program in the craft itself.

"Two days to go. We take down notes in the logbooks on board: we write down everything that has to be done during the 24 hours.

"I as doctor-research worker had to determine the main changes taking place in the astronauts' organism under conditions of weightlessness. I had to examine Vladimir Komarov and Konstantin Feoktistov in outer space itself, as well as observe my own organism. All this was essential because, though the data received from the spacecraft by telemetry gives the specialists much valuable material, all the same it is not exhaustive. The astronauts' accounts about how they felt helped of course, but naturally, these were not professional reports.

"Now comes the evening before blast off. We decided to take a walk before sleeping. The weather was clear, the wind was blowing, it was pleasantly chilly. We walk along the street. In the houses the lights have been put off. Everyone is asleep. We look at the sky by force of habit, murmur to ourselves the names of stars and constellations, which will be our orientation guides during the flight. We walk a lot, feel frozen, turn back. We come up to the wicket. The guard challenges:

'Who goes there? You cannot enter. The astronauts are sleeping. They must not be disturbed.'

"Somehow it is awkward to say that we are the astronauts...We stand, thinking to ourselves.

'You cannot enter' repeats the guard of our room firmly.

'But we have to,' Vladimir Komarov implores, 'You see, the fact is...'

'My orders are to let no one in,' interrupts the guard and slams the wicket door.

'Can't you see we are the men who live here?' butts in Konstantin Petrovich, who was quiet up till now. The guard recognized Feoktistov, begs forgiveness and lets us in.

"We got up at the right time in the morning, had a bath, finished our exercise and had breakfast. A car took us to the 'costume room'. Our timetable before the start was the same as that of the 'Vostok' astronauts. They had fully 1½ hours for putting on their spacesuits whereas we were supposed to be in light sports costumes. In general, we had about an hour. It seemed to us more like twenty-four!

"At last we sit in the blue bus. The same bus in which Yurii Gagarin and German Titov went. The bus stopped twenty or thirty meters from the rocket's base. There the members of the State Committee had already collected. A short report by Vladimir Komarov about the readiness of the crew for flight, and then boarding the craft. A lift takes us to the 'Voskhod', at the top of the rocket. To go up on foot is the same as climbing a staircase to the 15th storey. First Konstantin Petrovich and I went up. Vladimir Mikhailovich Komarov was the last. My place was at the far end from the hatch. Second was Feoktistov. He was in the central chair. Then came the

crew commander. The hatch was closed from the outside

"We start testing the devices. The only question that troubles us before the flight is whether we will be able to carry out the scientific research program.

'So that you don't feel bored, we are putting on music,' we hear the friendly voice of Yurii Gagarin in the earphones."

The music started.

"We know that half an hour before launching everyone must leave the vicinity of the rocket. All those who direct the launching are in a deep underground bunker, hundreds of meters away from the launching pad.

"A terrible noise reaches the observers on special platforms. The streams of flame that burst out of the rocket engine jets, resemble scorching pillars of fire.

"And how does the man sitting in the craft above this raging fiery spout feel? He hears only a constant sound, reminding him of the noise of a primus stove. A bit of a whistling hiss and that is all. You can talk. We were quite active in the cabin. The gravity forces at the time of the climb were not very high."

* * *

Much time has passed since the flight of the "Voskhod". Boris Borisovich successfully defended his Kandidat's thesis and has published a number of articles on various aspects of space medicine. But the main thing is, he participated as usual in the preparation and training of astronauts for space flights around the earth.

"Scientists," says the physician-astronaut, "have to do a lot so that the prolonged stay of man in outer space may not be a burden, and we are already nearing this stage. As before, weightlessness is the main obstacle in our path. Flights of 5–10 days are no problem. But months, years? The journeys to planets, for example to Mars? At the time of a prolonged flight, man loses weight and a number of vital substances are lost from the organism. As a result the weight-bearing and locomotor devices undergo changes; in simple terms, the strength of bone tissues gets reduced. The cardio-vascular system also works in a different manner."

"Perhaps science will find the means for neutralizing the effects of weightlessness?"

"Without doubt," replied Boris Egorov. "But time and new experiments are required. The hurdles standing in the path of man to the planets, can be overcome. The union of science, technology and medicine, which is getting stronger, will lead us to victory."

THE NEW ROCKET—SPACE COMPLEX "VOSKHOD"

THE FIRST THREE-SEATER

THE "Vostok" spacecraft were single-seat flying devices. During the flight the astronaut not only controlled the craft, took care of the working of several systems and assemblies and maintained radio and television communications with the earth, but also carried out various types of scientific experiments. A part of his time was also spent in sleep and rest.

In spite of the enormous importance of the investigations carried out by the first astronauts, still a lot remained vague. Not fully determined were the requirements of a craft to enable man to live and work in space, and carry on scientific investigations for a prolonged period. It became apparent that specialists must participate in the regular experiments. They could help in the development of improved spacecraft designs and systems and the safeguarding of the vital activity of the crew in orbit. Undoubtedly a physician was also required on board the spacecraft.

Thus the necessity arose of the construction of a multiseater spacecraft.

One of the most vital problems of astronautics, the exit of man from the satellite-craft into outer space, could also be solved. The further development of astronautics depended as much on the successful solution of this problem, as earlier advances had on the success of the first manned space flight.

Can an astronaut overcome the psychological difficulties connected with his exit into open outer space? Can he cross the threshold of the cabin? If yes, then can he work outside the craft? As long as these and a number of other questions remained unanswered, it was impossible even to think about the proposed permanent orbital stations for carrying out geophysical research, or about the assembly of interplanetary craft for flight to other worlds.

By creating the multiseater "Voskhod" in 1964–1965, Soviet scientists and engineers proceeded to solve these problems.

The spacecraft-satellite "Voskhod" is the world's first multiseater rocket-flown device. It consists of a three-seat cabin (recovery capsule), in which the crew is accommodated at the time of flight, and an instrument section. The weight of the craft is 5,320 kilograms.

The recovery capsule has a ball-like shape. On its body, engines are fitted for soft landing. The outer surface is covered with a layer of heat-resistant material, which safeguards the design from the effect of high temperatures at the time of descent to the earth. Three chairs, fitted with shock absorbers and a control panel; an instrument panel with indicators, the "Globus" device and signal table; the orientation systems control handle; the units of the system for safeguarding the vital activity of the crew, the control apparatus; the means of radio communication; food and water reserves; television, movie and still cameras, scientific instruments; apparatus for medical research: all these are fitted into the cabin of the spacecraft. The main and emergency parachute systems are placed in a special section of the cabin.

The design of the chair helps the astronauts in bearing more easily the effect of high gravity forces at the time of launching as well as during the return to earth.

For an all-round view and the taking of movie and still pictures, the members of the crew make use of three portholes and the external television camera with a video arrangement. The optical orientator of the manual control system of the craft is fitted on one of the portholes.

The chemical composition of the air necessary for breathing, humidity, normal pressure (about 750 millimeters of mercury) and temperature within the limits of 15–21°C is maintained in the cabin automatically or by the decision of the astronauts.

The high degree of reliability and hermetic sealing allows the astronauts to stay without spacesuits. This is very convenient and raises their working capacity.

The instrument section of the craft accommodates: radio apparatus,

In the "space" pavilion.

control devices, units of the temperature regulator system, sources of electricity and the engine plant, including the main (fluid) and the reserve (gunpowder) retrorockets. Because of the additional engine the "Voskhod" can fly on a higher orbit than the "Vostok".

The astronauts maintain two-way radio communication with points on earth on short and ultra-short waves. The radio technological means also provide for the determination of the parameters of the orbit, the reception of orders from earth, the transmission of television pictures of the astronauts, data about their condition, the parameters of microclimate and the level of outer space radiation in the cabin and data about the functioning of the craft systems.

The "Voskhod" can be made to leave its orbit as an earth-satellite and descend either automatically, or by manual control. At the time of automatic descent from orbit, the orientation system brings the axis of the retrorocket

in line with the direction of the sun. If the manual control system is used, then the crew orients the craft in outer space with the help of the optical device, with which the position of the craft in relation to the earth can be determined; or the video arrangement of the television system can be utilized.

Then the retrorocket is fired. During its work, the stabilizer system maintains the necessary orientation of the craft in outer space. The retrorocket reduces speed and as a result, the craft changes over to a trajectory of ballistic descent.

At the calculated time, the sections are separated at a command by the program mechanism. At the height of 5 kilometers, when the rate of descent is about 200 meters per second, the door of the parachute hatch is jettisoned and the parachute system starts working. The gunpowder engines for soft landing start working just near the earth's surface, and the recovery capsule with the astronauts lands practically at zero speed.

The recovery capsule of the "Voskhod" can land over water as well, since it is unsinkable.

A three-stage launch rocket with liquid fuel rocket engines, which develop a maximum total traction of 650 tons, is used for launching the "Voskhod" in a near-earth orbit.

The rocket-space complex "Voskhod" has been created under the guidance of the Chief Designer, Academician S.P. Korolev.

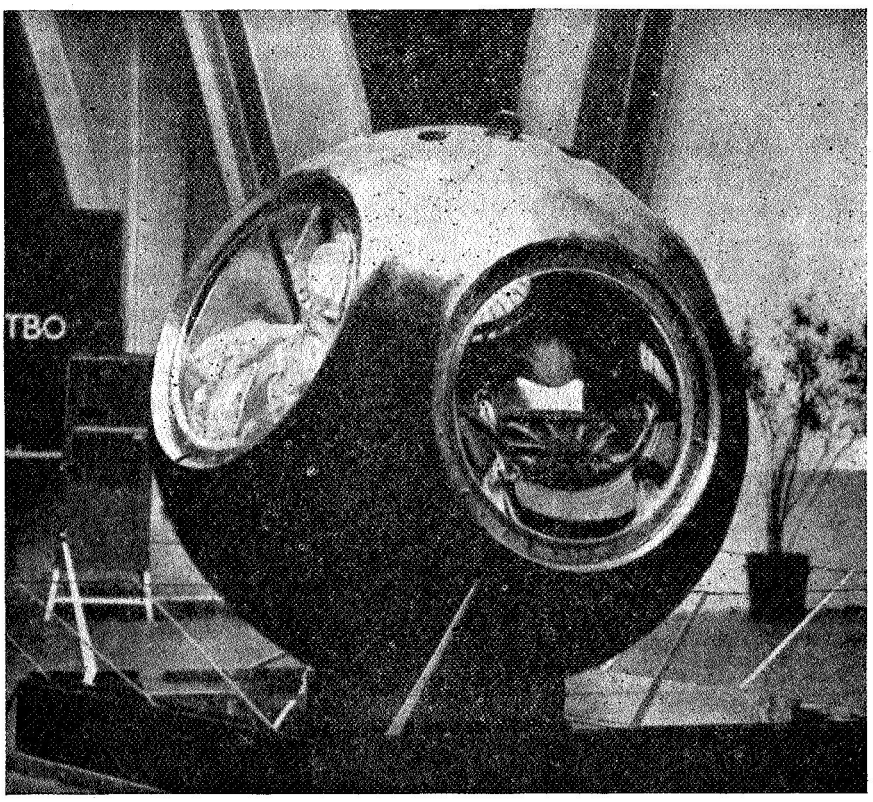
THE CREW IN ORBIT

The spacecraft "Voskhod" was launched from Baikonur cosmodrome on October 12, 1964 at 1030 hours. On board was a crew consisting of the commander, Engineer Vladimir Mikhailovich Komarov, the crew members—Konstantin Petrovich Feoktistov, Kandidat of Technological Sciences and Physician Boris Borisovich Egorov.

The aims of the flight were: to test the new multiseater spacecraft; to test the working capacity and cooperation of a group of astronauts consisting of specialists of different branches of science and technology; to carry out physico-technological and medico-biological investigations; to study the influence of flight factors on the human organism.

The program was expected to last 24 hours. It was proposed to make a landing in Kazakhstan, on the latitude 51 degrees north, during the 16th circuit using the automatic system of orientation.

"Voskhod" was put in orbit as an earth-satellite with the following parameters: apogee 408 kilometers and perigee 178 kilometers, inclination of orbit 65 degrees, period of completing a circuit 90.1 minutes. The members of the crew bore the high gravity pressure comparatively easily. Their feelings could be explained by the fact that there were now more comfortable chairs in the cabin. Some changes in the training of the astronauts, introduced in



Recovery capsule of the spacecraft.

the light of the experience of flight in "Vostok" craft, also had their effect.

When "Voskhod" joined the orbit, the astronauts proceeded to fulfill the flight program. Komarov reported to the earth that the craft had joined orbit as a satellite. Feoktistov started registration of the parameters, which characterized the working of the apparatus on board, and controlled the temperature, pressure and humidity in the cabin. He also corrected the watches on board the craft on being told to do so by the earth and checked the readings of the "Globus" device.

After examining his comrades, Egorov made a note of the results of his observations in the logbook: pulse, rate of breathing, reaction on changing over to the condition of weightlessness, general impressions. The physician also determined the threshold of sensitivity of the vestibular apparatus.

When "Voskhod" came out of the shade, Komarov oriented it in space using manual control. In accordance with established tradition, the craft

was oriented during its first circuit so that the crew gained confidence in case of an emergency. They knew that the engines could be switched on at any time and the craft made to descend and land by the astronauts themselves, without any help from the earth.

Feoktistov took movie-films through the porthole with the help of the "Vzor" device. At this time Egorov was engaged in medical investigations. When the first circuit was about to be completed and the craft was flying toward Soviet Union territory, the commander switched on the transmitter and reported the progress of the flight and the crew's condition.

Later on Komarov oriented the craft manually several times with respect to the sun, the stars, the earth's horizon and the "flight" of the earth's surface in the field of vision of the optical orientator "Vzor". All this time Vladimir Mikhailovich determined the orientation time, discharge of the operating parts of the micro-engine, the convenience of the controls, etc. Radio communications with the earth, the working of the systems, making observations of earth's surface at various degrees of illumination, determination of the light sensitivity of the eyes and the possibility of visual orientation were also included in the duties of the commander. The results of the experiments and observations were noted down in the logbook, as well as on the tape recorder.

Much attention was paid to the investigation of the horizons of the earth during the daytime and at dusk. Feoktistov took photographs of the earth's horizon, observed the boundary between the earth's surface and the atmosphere and the halo near the earth's horizon. These investigations were carried out with the aim of navigation and orientation of spacecraft and automatic stations.

During orbital and interplanetary flights our planet can be used as a supporting luminary. Since the earth's halo consists of various color layers, it was required to select one of these as the basic color for astronavigational calculations, and the orientation of spacecraft and stations in outer space. Feoktistov carried out a detailed program observing the starry sky also for space navigation and astro-orientation. He checked the possibility of orientation by star from the portholes of the craft and determined the accuracy of the astronavigational measurements taken with the help of a sextant.

Feoktistov tested the working of the system of the craft's orientation from the ionic pickup unit. During the "Vostok" flights, it was possible to carry out orientation in outer space only in those parts of the orbit illuminated by the sun. The new orientation system of "Voskhod" permitted orientation of the craft over the dark side of our planet as well.

The scientist carried out experiments to observe the behavior of liquid placed in vessels under conditions of weightlessness, observed the earth's atmosphere, Aurora Borealis and the shining particles and controlled the

devices and the parameters of the apparatus on board during the whole flight.

Egorov made physiological observations of the cardio-vascular system, the arterial system, the functions of the vestibular apparatus, the central and peripheral nervous systems. He investigated the external breathing, the interchange of gases and the amount of energy spent under conditions of weightlessness. He took blood from his comrades for investigation by using a Frank needle, measured blood pressure, carried out functional tests by applying doses of irritation to the vestibular apparatus.

The physician registered the bio-electrical activity of the brain and the electrical potentials created during the arbitrary or involuntary movement of the eyes. He also determined the parameters characterizing the coordination of movement at the time of drawing figures etc.

The duties of the physician also included the control and evaluation of the effectiveness of the working of the lifesaving systems of the craft and to give medical aid to crew members, if necessary. The astronauts felt well during the whole flight, so Egorov had no opportunity to start his medical practice. But he gave an accurate account about the possibilities a physician has on board a spacecraft.

The regeneration, temperature control and driving systems worked reliably and maintained a normal microclimate in the cabin. Because of artificial ventilation, the astronauts could stay in the cabin in woolen sports costumes.

The working ability of all the members of the crew remained high. They carried out coordinated movements without any difficulty. Their handwriting did not undergo any considerable change. The astronauts worked successfully with the most varied scientific apparatus under conditions of weightlessness.

The food ration included hard natural products, packed in thin plastic packets, and liquid (puree-like) products in aluminium tubes. The cooked dishes had a pleasant taste in the unwarmed state and also an attractive look. The astronauts' appetites were normal.

Komarov, Feoktistov and Egorov slept by turns, 3 to 5 hours each. Sleep was sound, without dreams.

The program was completed by the morning of October 13. At a command from the earth, "Voskhod" left orbit on the 16th circuit and landed in the given region, 312 kilometers northeast of Kustanai, at 1047 hours. The flight had lasted for 24 hours 17 minutes.

The astronauts bore the high gravity pressure during the descent well.

The flight of the multiseater satellite-spacecraft "Voskhod" was another important step in the path of man's penetration into outer space. The variety of experiments and investigations carried out directly on board the craft was considerably widened because of the presence of an engineer, a scientific worker and physician as members of the crew. As a result, much

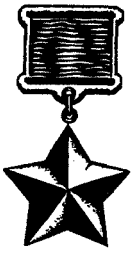
valuable scientific and technological information was collected which would be of great importance in working out designs of new spacecraft and their many systems, as well as for safeguarding the health and high working capacity of the astronauts under conditions of orbital flight.

It can be stated categorically that the crew of "Voskhod" was the prototype for future interplanetary expeditions.

Pavel Ivanovich Belyaev,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On March 18, 1965 in the Soviet Union, the spacecraft satellite "Voskhod-2" was put into orbit as a satellite of the earth by using a powerful launch rocket. It was manned by a crew of two, consisting of craft commander, Pilot-Astronaut Colonel Pavel Ivanovich Belyaev and co-Pilot-Astronaut Lieutenant Colonel Aleksei Arkhipovich Leonov.



"Voskhod-2"

For participation in the world's first exit of man from a spacecraft into open space, accomplished during the flight of the manned spacecraft-satellite "Voskhod-2", the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Pavel Ivanovich Belyaev, commander of the "Voskhod-2". The Hero's bronze bust has been installed in the city of Moscow.

* * *

For making an outer space flight in the spacecraft-satellite "Voskhod-2", the title of the "Pilot-Astronaut of the USSR" is conferred upon Pavel Ivanovich Belyaev, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

Pavel Ivanovich Belyaev was born on June 26, 1925 in Chelishchevo, a village in the Poslyatin district of Vologoda region.

On leaving his secondary school in 1942, he joined a factory where he worked first as a lathe operator and then as examiner of the finished product.

In 1943 he volunteered for the Soviet Army requesting that he should be sent to flying school. His request was granted.

He took part in the war against Japan as a fighter-pilot and later continued his service in military units.

As one of the best pilot-commanders, Belyaev was sent to the Air Force Red Banner Academy in 1956, from where he graduated in 1959.

He has been a member of the CPSU since 1949.

As commander of the "Voskhod-2", Pavel Ivanovich Belyaev successfully completed his special training, and understood the working of his craft to perfection.

He was awarded the Order of the Red Star and several medals for his worthy service to the Soviet Army.

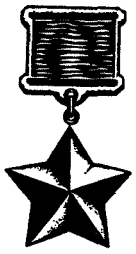
Belyaev died in January 1970.

Aleksei Arkhipovich Leonov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On March 18 during the flight of the spacecraft "Voskhod-2", for the first time a man went out of the craft into outer space.

During the second circuit of the flight, the second pilot-astronaut Lieutenent Colonel Aleksei Arkhipovich Leonov, made an exit into open space. He was in a special spacesuit with an automatic lifesaving system. He went up to a distance of five meters away from the craft, successfully completed a complex of planned investigations and observations and returned safely into the craft.



"Voskhod-2"

For making the world's first exit from a spacecraft into open space, accomplished during the flight of the manned spacecraft-satellite "Voskhod-2", the title of the Hero of the Soviet Union with the award of the Order of Lenin and Gold Star Medal is conferred upon pilot-astronaut Aleksei Arkhipovich Leonov. The Hero's bronze bust has been installed in the city of Moscow.

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For making an outer space flight in the spacecraft-satellite "Voskhod-2", the title of the "Pilot-Astronaut of the USSR" is conferred upon Aleksei Arkhipovich Leonov, a citizen of the Soviet Union.

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FROM THE HERO'S LIFE

Aleksei Arkhipovich Leonov was born on May 30, 1934 in Listvyanka, a village, in the Tisul' district of Kemerovo region.

In 1953, in response to an appeal to the Young Communist League, he entered flying school. After graduating from the Chuguev Air Force School with distinction, Leonov served in various units of the Air Force.

His Command gave him a good testimonial and valued his flying mastery, self-control, equanimity and discipline. Leonov was given the title of "Air Force Pilot Third Class". He is a good parachutist and has made over 100 jumps of various grades. In 1960 he became an Air Force Paratroop Instructor.

The pilot-astronaut graduated from the N.E. Zhukovskii Air Force Engineering Academy.

He has been a member of the CPSU since 1957.

He was awarded the Order of the Red Star and the medals "40 Years Service in the USSR Armed Forces" and "For Irreproachable Service, Class III" for his service in the Soviet Army.

A.A. Leonov is a member of the Union of Artists of RSFSR.

STEPS OVER THE PLANET

"M-a-n ha-s go-ne out in-to ou-ter spa-ce."
"M-a-n ha-s go-ne out in-to ou-ter spa-ce."

ALL over the planet the calm, rather too calm, voice of astronaut Pavel Belyaev, "Voskhod-2" commander was resounding. And although he was reporting the most important event in the history of astronautics, he did it simply, in a matter of fact manner. But the whole world came to know of it at that moment. Millions of televiewers saw on their screens Aleksei Leonov, a fearless son of the earth, soar alone in space for the first time during a near-earth orbit. He soared without fear of the incinerating rays of the sun.

"M-a-n ha-s go-ne out in-to ou-ter spa-ce..."

Aleksei Leonov, the first inhabitant of the earth to go for a walk in the open in outer space, repeated a number of times how it all took place.

"Just before the launching of 'Voskhod-2', the investigators of outer space, scientists, designers, physicists, physicians, biologists, had collected at

the cosmodrome where Sergei Pavlovich Korolev was conducting the technological guidance of the experiment. During those days he was seen everywhere: in the assembly building where the systems of the craft were being tested, as well as near the launch rocket now being linked up with "Voskhod-2". According to custom, the scientist went up to the craft when it was standing at the launching pad. Everything was his personal concern. And although hundreds of specialists were getting the rocket ready, the Academician still controlled a lot himself.

"He found time for conversation with us too. The meeting a few hours before the flight has stuck in my mind. Sergei Pavlovich came in the evening to our small house, where we passed the night prior to the flight, like all our friends had done in their turn. He came and slowly took off his dark blue overcoat, which he always wore when he went to the cosmodrome; hung his cap with flaps on a hook and sat down heavily. It was apparent that the scientist was very tired. And why should he not be tired! He was on his feet from eight in the morning till midnight, always in action. Now only his brown eyes were gleaming—as always.

'How do you feel, young eagles?', he said uttering his favorite phrase.

'Excellent', replied Pavel Belyaev using service language.

'And simply, humanly?', queried the Academician. It seems the very formal answer did not please him.

'Everything is normal, Sergei Pavlovich,' I said in support of Pavel Ivanovich. 'Here, I have colored pencils ready. I am getting ready to draw a little. Aivazovskii was a painter of seascapes, but I want to become a painter of outer spacescapes.'

"Sergei Pavlovich smiled at the joke and, bending his head a bit, threw a tenacious glance first at me, then at Pavel. We understood that a business-like talk was in the offing.

'Preparations for the start are going on normally. There were a few shortcomings which the scientists did not hide. Now they have been solved. The flight and the exit experiment are difficult things. We demand from you accurate fulfillment of the program...' Sergei Pavlovich continued. 'You have to take into account all the circumstances yourself and take judicious decisions. It is not possible to foresee everything on the earth. We spoke about this with you several times during training and I repeat, you must act according to the circumstances. The earth will, of course, give you necessary advice. But in the craft, your life and the fate of the experiment are in your own hands.'

"Keeping quiet for a while, Sergei Pavlovich smiled, then fumbled in his pockets for the pipe with validol, with which we knew he never parted, but at the last moment he decided not to resort to its help.

'Anything is possible. If you notice any shortcomings, don't ask for trouble. Do you get me?' the designer asked strictly. 'Records are not needed, what

After the return from outer space.

is required is a serious scientific experiment. You well understand how much we expect from it. What we are going to carry out tomorrow will open a whole new trend in space research.'

"The scientist got up, looked at the books lying on the table, then softly, like a father talking to his children, said :

'Go to bed, young eagles, tomorrow you have difficult work to do...'

"I and Pavel Belyaev got up early that morning, March 18, 1965. We pulled the blinds. Soft snow was falling outside the window. First, light physical training exercises. Then a meeting with the physicians for a pre-flight medical checkup. The doctors keep us nearly an hour. We started chaffing :

'Look, the rocket will fly without us'.

'Don't get excited,' physician Andrei Viktorovich counters. 'Otherwise your blood pressure will go up and we'll have to send your doubles instead.'

"We calm down. But really! The desire to escape! Now everything is finished. Breakfast, not very plentiful in volume, but sufficiently caloried, very much like 'space' food.

"Andrei Viktorovich looks at his watch; time to put on our spacesuits.

This procedure is fairly long. Sensors are fixed on the body for the doctors to learn of our condition during flight. Then the putting on of the spacesuit. The specialists do it all quickly, but it seems to us as if the time passes very slowly. Even the leisurely Pavel Belyaev prayed,

'Can't you get it over with a bit quicker?'

'That's impossible,' snapped the specialist who was dressing him.

"We measured our outer space armor a number of times. It not only has all the necessary qualities for flight and exit into open space, but at the same time has great beauty. Being snow-white in color with a stripe down the side, it seemed to me more beautiful and elegant than the ones used by the first six astronauts. But of course, its main merit was not the beauty. It fully provides for the independent vital activity of the astronaut. The dread conditions of outer space surroundings are forgotten in it. In this dress man can survive and work and move about too.

"The testers, and even we ourselves, tried our dress under conditions of high and low temperatures, and in a vacuum. The spacesuit was checked in the centrifuge, vibrostand and on special machines. The sole aim was to test the static and dynamic strength of the dress, the extent of radiation and ultraviolet radiation effect on it.

"A lot can be said about the spacesuit since it is a complex engineering device, allowing a man to live and work outside the craft. There is no doubt that spacesuits have a great future, and they will become more and more improved with the passage of time...

"Having dressed ourselves according to outer space requirements, we entered the bus and sat in special chairs. Yura Gagarin, Volodya Komarov and Boris Egorov sat next to us. According to tradition we started singing. How can you do anything without a song!

"The bus stopped at the launching site near the rocket. There were caps of fluffy snow on the rocket and service towers.

"The State Committee had already assembled. Its president, a short-statured engineer, whose services to the State have been recognized by the award of the title of Hero of Socialist Labor, heard Pavel Belyaev's report on our readiness for flight. We started taking leave of our friends. Although the pressure helmet got in the way, all the same, following the Russian tradition, we exchanged kisses three times with Sergei Pavlovich Korolev, Gagarin, Komarov and Egorov.

"I went up first. Here is the entrance hatch. Engineer Zhenya, a wonderful specialist and a person of my own age, helped me in sitting in the chair. The hands were placed on the elbow-rests and the feet on special foot-rests. Belts pressed me to the chair. The engineer went over to meet Pavel Belyaev.

"For a few minutes I was left alone. First of all I take a look at my belongings, then the control panel of the airlock chamber. It is just over my head. On metallic tumbler switches are the words : 'AC hatch', 'AC valve'

and simple 'AC'—which means 'airlock chamber.'

"Pavel Belyaev appeared :

'How is everything?'

'Everything O.K., comrade commander.'

"Pavel checked with his natural thoroughness how I had settled down, touched the belts to see if they were properly tied, and then sat in the commander's chair.

"The control panel of the craft was above his chair. For manual orientation of the craft in outer space there was a long black handle. A little higher were instruments. And, finally, a small black knob under the safety staple. It fired the retrorocket device, when the craft returns to the earth. I mention only the prominent equipment.

"Zhenya, who was responsible for our seating in the cabin, who had said goodbye to almost all the astronauts before us, now stretched out his hand :

'Happy landings, friends.'

'Thanks,' Belyaev replied.

'Till we meet on earth,' I added.

"Immediately the entrance hatch of 'Voskhod-2' was hermetically sealed. Within a short time all the service personnel would leave the site, and we two would be left together at the top of the space rocket.

'This is *Zarya* (Dawn). Are you receiving me?'

'This is *Almaz* (Diamond)', answered Belyaev. 'Receiving you loud and clear.'

'Start checking the instruments.'

'Roger.'

"As envisaged in the program, we checked the working of the systems before the start and reported that everything was fine.

"We hear there is only five minutes to go...I become impatient. And the minutes seem to stretch on and on...they feel more like versts!

'This is *Zarya*. Everything O.K. here.' We hear the calm, confident voice of Academician Korolev. 'How do you feel, what is the mood like?'

'This is *Almaz*,' answered Belyaev, 'We feel fine. Ready to go.'

'Thank you,' the scientist answered simply. 'Happy journey. Till we meet on earth...'

"We thanked him. Without talking to one another, we look at the watches. The second hand was nearing 1000 hours Moscow time. We close the transparent visors of our pressure helmets and we are ready...

'Stand by to fire.'

"We look at one another. Pavel's eyes are serious, concentrated.

"Then the order: 'Fire!'

"A hollow rumble could be heard. We felt how the craft shuddered as it rose. At that very moment a heavy force started pressing us. It pressed us very tightly to the chair.

'Happy journey, friends!' Gagarin wished us.

'Everything is normal,' reported Pavel Belyaev to the earth. 'High gravity forces are increasing. Vibration is insignificant.'

"The craft rises higher and higher. It has crossed the clouds. Sunrays pierce through the porthole.

"The commander looks attentively at the instruments, making signs to me at times, that everything was going on strictly according to the graph. We could feel how, one after the other, the stages of the launch-rocket were completing their work. We wait for the most crucial moment, the firing of the last stage. We know that this moment is being awaited at the cosmodrome, too. If the last stage does not start working, then we have to return to earth without achieving anything for our pains.

'It's started working!' Belyaev cried. 'This is *Almaz*. The last stage has fired. Everything is normal. We are in orbit!'

"Pavel's face was shining with joy. We shook each other's hand. 'Voskhod-2's' flight had started. Our most cherished dream had come true. We were in outer space.

'Well, Lesha, shall we start?'

'Let's go.'

"We started the preparations for my exit into open space, which we had to carry out during the second circuit.

"Many people asked me, what thoughts did I have during those minutes, when I was about to step outside the craft. Perhaps, I had none apart from the most needed ones,—to enter the airlock chamber and from there step into the outer space abyss. The most important thing was—not to distract one's attention from the task: not to allow even one hasty step. To the surprise of physicians, I did not experience any fear. There was no emotional upsurge either. This can be explained by physical and, if you like, psychological preparedness. One has just to look at the medico-biological data to be convinced of what I have said. The pulse and blood pressure were usual for the flight. Everything was carefully thought out and accurately worked out. Naturally, I had prepared my morale for the fact that I would be the first to meet outer space face to face.

"Unhooking the belts of the chair, I got up. Pavel Belyaev helped me in putting on my back the haversack with a stock of oxygen and attaching it to the pressure suit. Then he equalized the pressure in the airlock chamber and in the cabin. The commander pressed the knob, and the hatch into the airlock chamber opened slowly. I could not contain myself as I looked in. Lustreless lamps were on, and the movie camera was hanging in its usual place. Our designers had put a control panel in the airlock as well. If it was necessary, I could at any moment take over the control of the airlock mechanism system.

'Start airlocking,' commanded Pavel Belyaev.

Out hunting.

"I raised myself over the seat and easily 'swam' into the airlock chamber. At once I adjusted the necessary pressure in the spacesuit. Once again I tested its airtightness. I heard in the earphones :

'Lesha, do not hurry. Take it easy.'

'I am not hurrying.'

"I tested the tightness of the pressure helmet and the light filter, then checked the supply of oxygen from the bottles kept in the haversack.

'Everything is normal. I am ready for the exit,' I reported to Belyaev.

"In reply I hear :

'Somewhat early, Lesha.'

"Later Pavel told me that I had carried out all the operations for the exit into outer space very accurately, but a bit before the time envisaged in the program. And I was impatient: such is my character. But Pavel Belyaev has his own character. Only after he was absolutely certain that the lifesaving system was functioning normally, that my pulse and breathing were within norms did he give the command :

'Make the exit!'

"I hear the hatch of the cabin close behind me. I touch with my hands

the lead connecting me with the craft. It served an additional purpose too: the telephone lines connecting me with the commander and with the earth were incorporated in it.

"Pavel Belyaev reduced the pressure in the chamber and opened the exit hatch. And at this split second brilliant light, similar to an electric welder's arc, hit the chamber and my eyes. But the sun did not blind me: the light filter attached to the pressure helmet was guarding me.

'May I go out?' I ask the commander. But he is again taking his time. Undoubtedly, he is checking the readings on the instruments. And again my friend's calm voice.

'Do not hurry. We shall do everything according to plan.'

"I wait. And search for the earth with my eyes. There it is, the dear one. Our planet looks flat, and only the curve at the ends reminds us that the earth is round. This is explained by the fact that the height at which we were flying was not so great that the huge earth can look round, like the moon. It was a sublime picture! Through the clouds the Black Sea and Caucasus summits could be seen. I searched with my eyes for Sochi, where we had rested so often. At first I couldn't find it. Yes, there it was, a small white triangle in between the hills and the sea.

'Time to go. But do not hurry,' warns Belyaev. 'Off you go! Keep talking. Tell me everything you see.'

"I started going out of the airlock leisurely. A second passed and I was in the outer space abyss. Only the thin lead was joining me with 'Voskhod–2', the small earthly world, in which my friend was at work.

"At this very moment Belyaev announced to the world :

'M-a-n ha-s go-ne out in-to ou-ter spa-ce.'

"I look around me. Right in front is the black, black sky. The stars are bright, but they do not twinkle, nor even flicker. The sun is also not like what is seen from the earth: it is without the halo.

"I took off the cover of the movie camera to take my pictures. Where should I put it? I threw it in the direction of the earth.

"I was feeling fine. I did not feel the psychological barrier at all, which, according to some scientists, should have proved to be an unassailable obstacle at the time of man's meeting with the outer space abyss. There was no time to think about it. The craft commander constantly kept track of my stay in outer space. His calm, confident voice ('Do not hurry, Alesha. Act as you have been taught') soothed me, and then I simply forgot myself, so enamored was I of the unusual view around me. During those minutes I maintained radio communication not only with Belyaev, but with earth also. And this meant a lot. Outside the 'Voskhod–2' I heard Radio Moscow. Announcer Levitan was reading TASS information about our flight. It was a bit strange to hear this at such a terrific height.

"Suddenly the well-known voice of Yura Gagarin can be heard in the earphones :

'How do you feel, Lesha? Tell me what you see' "There is so much that I can't hope to tell you everything," I answered. Then I reported on the situation officially.

"In all dimensions the universe is boundless. Below me, far away is the earth. I agree with other astronauts that our earth is beautiful, very beautiful. I looked at it and was completely charmed by it. But when did I work? All that I was doing, was in fact my work. I went out into the vastness of outer space and first moved one hand, then the other, then my legs. Everything was normal! Very good. The vestibular apparatus was in order. Then I threw open my arms like wings. It was a very pleasing sensation. It must be remembered that all that I am now telling, was planned in the program.

"After some time I got hold of the lead and pulled it quite energetically. With my hands I had to fend myself off from the craft, which had moved near. A thought flitted across my mind, that I might strike the craft with my pressure helmet's visor. Having flown up to the airlock, I opened it with my hands. It was very easy to do. I was sure that, after adapting oneself, it is possible to move in these unusual conditions sufficiently accurately and with coordination.

"I fully utilized the twelve minutes I was outside the craft. Movement with the hands is an element in the process of working, without which it would be impossible to conquer outer space. My double Zhenya Khrunov, together with Aleksei Eliseev made use of our experience. In January 1969 they went out of the craft together and carried out a number of experiments, including a spacecraft transfer from 'Soyuz–4' to 'Soyuz–5'. Those who have decided to conquer near-earth outer space and make it useful for people in the future, have to carry out the assembly of an orbital station, which would involve the taking out and fixing of apparatus outside the craft's cabin, electric welding and a lot of other things.

"Some people want to compare 'swimming' in outer space with swimming in water. In water one feels something supporting you. In outer space there is no such feeling. It seems as if you are simply flying near the craft. It is pleasant to realize that you are very strongly tied by a lead to this small part of mother earth. If you could only see how fantastic 'Voskhod–2' looks in outer space! I looked at it from a distance of five meters. The portholes look like extremely big eyes, and the antennas like gigantic tentacles.

"I was feeling excellent and in cheerful mood. I did not wish to part with the freedom of outer space. And even after receiving the command to return into the craft, I pushed myself away from the edge of the airlock to find out the reason for angular speeds during the first moments after the push. It seems that people who will work in outer space, will still have to labor a lot on the

problem of orientation of the body in space under conditions of weightlessness.

"Don't think that all that I was doing alongside the craft, did not call for effort, that everything was as easy as it would have been on earth. No! I got pretty tired. Don't forget about the spacesuit under pressure. Although it ensured complete safety, it was uncomfortable to work in. My movements were restricted. The gloves were not as elegant and comfortable as those we normally wear. For example, a lot of effort was needed to take off the movie camera from the bracket and push it into the airlock.

"I stayed out under conditions of outer space for 24 minutes. And for writing down all that I saw and what work I had carried out, I needed about 1½ hours. I put down everything in the logbook on board.

"Thus, although it was good to be in outer space, it was better to be back inside! The craft is like your own house and in the cabin was my friend Pavel Belyaev.

"The first thing I said when I reached 'home,' was:

'Salute, commander!'

"And he answered:

'Well done!'

"The hatch was closed, the pressure was normalized and our flight continued. Although it might seem we were standing at one place to do our experiment, in actual fact we were moving with a speed of approximately 28,000 kilometers per hour.

"On the next day, March 19, it was my turn to say, 'Well done!' to Pavel Belyaev. During the 18th circuit, utilizing the manual control for the first time Pavel started bringing the spacecraft down to earth.

"When 'Voskhod–2' descended, a fiery storm was raging outside the portholes. Drops of metal were falling on the glasspanes, like drops of rain on a car windscreen. The landing was soft. I must say that manual control landing increases the commander's responsibility. It is one thing when earth fires the retrorockets, and another when you yourself have to manually orient the craft in outer space and push the knob for firing the retrorocket. 'Voskhod–2' landed in the taiga: very high fir trees with snow almost 2 meters deep. After some time we informed the cosmodrome: 'Everything is in order.'

"I climbed out of the cabin. The forest was just like the one in the Siberian taiga, where I was born. We started breathing earthly air with pleasure. It was wonderfully delicious, impregnated with the fragrance of conifers.

"A few words about my impressions of the flight. We are accustomed to see the stars with a cold bluish shine. From outer space they are a pure gold color and as if scattered by a careless hand against the black backdrop. I drew them with colored pencils in the logbook on the craft. By the way, it is not so difficult to write and draw in weightlessness. Only the pencil has to be placed with greater power on the paper and this needs practice.

Aleksei Leonov in K.E. Tsiolkovskii's study.

"The earth startles one with the richness of colors. When the craft came from the dark to the light side of the earth, we saw one range of colors, but when the spacecraft whirled back from the light to the dark side, there was a completely different color scheme, with blue, azure and dark blue tones predominant.

"During the flight our attention was attracted to an object bathed in the sun's rays. Pavel and I cried out, surprised and happy. To one side of the craft, approximately a kilometer away, an artificial earth satellite was 'swimming'. This meeting excited us a lot. The thought struck us that a time will come when meetings in outer space with other envoys of the earth will become usual."

* * *

...After Aleksei Leonov's return to the craft, Pavel Belyaev informed the earth:

"The mission of the astronaut's exit into open space and his return to the craft has been fully carried out. The parameters in the cabin are within the norms. Further work is continuing, strictly according to program."

Pavel Ivanovich had enormous self-control and amazing modesty. He was always like that. After the return of the astronauts to the earth, we read in a newspaper a letter written by a Bulgarian pilot, Belchev. He recalled an incident. Captain Belyaev was imparting flying skill to some young Bulgarian pilots who had come to the Soviet Union for training. Once when Belyaev was flying with another pilot, Latev, the engine stopped. At the airport the plane was being followed with anxiety. They thought it would be necessary to abandon plane. Belyaev informed them by radio that he would not abandon plane and would do everything he could to land the aircraft. The catastrophe was averted. He managed to land.

"Why didn't you tell us about this?" friends asked Pavel Ivanovich.

"But what is there to tell?" shrugged Belyaev folding the telltale newspaper and putting it into his pocket. "Let's go!"

...In the small flight control room, the communication center of the cosmodrome, the journalists met S.P. Korolev. The craft's launching and man's walk in open space had been successfully carried out, and the scientist was in that triumphant, elated mood, which crowns the enormous expenditure of nervous energy: his aim had been achieved. Sergei Pavlovich took out his gold-framed spectacles, cleaned them, then quickly looked at the sheets of papers with our questions.

"All right, I will try to answer."

He kept quiet for a minute, probably arranging his thoughts so as to speak clearly and concisely. The Academician did not like long conversations.

He began:

Artist of "Neptune" newsletter.

"During the last years, when so many flights into outer space have been made right in front of our eyes, unnoticed we have changed over to another concept. Take a look: first we flew one-seat craft, then there were two-seater craft...

"I think I am not wrong in predicting the next step. Soon the question will arise, what is the sense in launching such costly systems, like a spacecraft, for only a few days in outer space? Better they should be launched into orbit and kept there for considerably prolonged periods. And the supply of all the necessities to these craft, the delivery and change of crew, and so on, should be carried on with the help of simplified types of space apparatus, which naturally must have airlocks for linking with the craft in orbit."

Sergei Pavlovich interrupted himself, looking at us as if asking whether everything was clear. Then he summarized what he had said.

"Thus unnoticed we are moving along the path of qualitative changes in our notions, in our directions of work for the conquest of outer space, which for the time being is in near-earth outer space with orbital flights around the earth."

The Academician leaned back in his chair and stretched his hands forward. It always seemed to us his hands were very small and gracious for such a huge and stocky figure. This was particularly noticeable when the scientist held his chin in his hand, lost in thought, with eyes turned upwards. In general he liked looking at the sky. Now also he was looking through the window at the blue March sky.

"But speaking about more prolonged and distant flights, then of course, you understand comrades, that the craft cannot fly in isolation. At present the crew can only make radio contact: there is no means of rescuing one another, or of changing crew."

Again there was a short pause. Looking at the questionnaire from the corner of his eye, Sergei Pavlovich seemed to be asking himself, "Why is it necessary to go out into open outer space?"

"I think this question can be answered very simply... While flying in outer space, one cannot help but go out into open space, just as when sailing in the ocean, one must learn to swim. This means that a whole lot of operations are involved at the time of the meeting of craft. Craft-repair is another consideration. For instance, we are seriously planning for the astronaut, having once gone out into open space, to be able to carry out all the necessary repairs and corrections even to the extent of welding in space."

Having detected some surprise in the eyes of the people present, the scientist added:

"This is not fantasy. It is inevitable and the more the people flying in space, the greater will this need be felt.

"And, finally, a situation may arise when one craft will have to give help to another. But how? The craft are heat resistant and of very strong design.

One may come up to the craft and yet not be able to do anything. If the craft is depressurized by opening the entrance hatch, then the people inside will die. Consequently, an airlock system has to be devised which allows the necessary help to be given."

During the conversation several times we noticed how Sergei Pavlovich could suddenly interrupt the conversation about something concrete, become concentrated and draw a rough plan of the future impromptu. He could dream aloud. So it happened this time also.

"Of course, one may let one's imagination run away a little," the scientist continued. "Let us suppose there will be big craft and they will not be able to come closer to one another than a distance of ten kilometers. They will be seeing one another with the help of radio technology. The question arises, how to go over from one craft to the other? Probably, a special type of outer space 'taxi' will have to be designed to send with a man in it to a distance of about twenty kilometers or so. The passenger of such a 'taxi' must be able to see his own craft and the other toward which he is going. He should be in contact with, and should be able to 'swim up to' this other craft. Naturally, the astronaut's return to his own craft is provided for in all cases."

We heartily congratulated Sergei Pavlovich on Aleksei Leonov's walk in open outer space.

"I accept these congratulations on behalf of the big collective which prepared and executed this experiment. It must be said that the first exit of man into open space is an event of exceptional importance. It opens the path toward a most important trend in the production of space apparatus and in outer space research itself."

. . . Twenty-four hours after this conversation Pavel Ivanovich Belyaev, the commander of the "Voskhod–2", made a manually controlled landing of the craft on earth, for the first time in the history of outer space flight.

"This is also a very important moment in the mastery of space technology, in the test of its reliability," commented Academician S.P. Korolev.

* * *

After his flight, K.P. Feoktistov said that only a painter or a literary artist could give people a complete picture of the beauty of the earth, and the overwhelming silence of outer space. Aleksei Leonov not only took the first steps in the freedom of open space, but also became its first artist. His drawings and pictures, dedicated to the conquest of the universe by man, were drawn at first hand from the original. They were published in newspapers and sketches, which are now part of an artistic "outer space collection", and were displayed in Moscow at the exhibition "Outer Space Through the Eyes of an Astronaut." Undoubtedly many people know "Self portrait" by Leonov, where he has shown himself hurtling along in near-earth orbit.

He has another picture called "Sunrise." Somewhere at the boundary of the earth and outer space the sun appears, as if tearing asunder the blue halo of the planet. The astronaut paints with all the richness of the colors that light up the earth. This picture, like the others painted by Leonov, is not only a piece of art, but also in its own way, a kind of document, which has scientific value.

MAN IN THE OPEN IN OUTER SPACE

THE spacecraft "Voskhod–2" blasted off from the Baikonur cosmodrome on March 18, 1965 at 1000 hours. The crew consisted of the commander, Pavel Ivanovich Belyaev and second pilot, Aleksei Arkhipovich Leonov.

The aims of the flight were: the exit of the second pilot from the cabin into open space and completion of a number of experiments outside the craft; carrying out medico-biological investigations; the solution of several problems of outer space navigation and observation and study of the earth's atmosphere.

Much work on the production of a spacesuit, modernization of the "Voskhod" craft, and prolonged and painstaking preparation of the crew, preceded the launching.

There were enormous technological difficulties to be solved before producing a spacesuit in which the astronaut could not only stay outside the craft for some time without any danger to health, but also one in which he could move about freely and work. For this a considerable effort was needed on the part of the designers, doctors, physicists, engineers and technicians. A

thin cover of the spacesuit had to safeguard the astronaut from the destructive action of the outer space vaccum, from sharp changes in temperature, (reaching hundreds of degrees), from cosmic rays, micrometeors and dangerous solar radiations.

On the reliability aspect too, special demands were made on the spacesuit. Even a minute depressurization could lead to the death of the astronaut.

At the time of preparing for the flight of "Voskhod–2" the pilot-astronauts participated in the working out of the draft plans for the spacesuit, the airlock chamber, the systems for controlling airlocking and all the additional systems and instruments which were not in the first craft of this type. The astronauts took part in testing the new equipment and instruments and made the necessary proposals for completing the work.

Putting on the spacesuits, the astronauts underwent training in the aircraft laboratory, where a full-scale model of "Voskhod–2" complete with the airlock chamber was placed. They rehearsed all the operations of exit from the cabin into outer space, approaching and leaving the craft in free space under conditions of short-duration weightlessness.

The satellite-craft "Voskhod–2" was launched into an orbit close to the calculated one. The maximum height during the first circuit was 498 kilometers, the minimum 174 kilometers. The period of orbiting the earth was 91 minutes; the angle of inclination of the orbital plane to the plane of the equator was 65 degrees.

The preparation for the exit of the second pilot into open outer space started immediately after the craft went into orbit. Belyaev helped Leonov put on the haversack with the store of oxygen on his back, when "Voskhod–2" was flying over Africa. The astronauts checked the spacesuits. Then the hatch into the airlock was opened and Aleksei Leonov "swam" into the airlock chamber. After "swimming" out of the craft, the astronaut saw the Black Sea and Caucasus Mountains. In free space Leonov came up to the craft and backed away from it five times. The first time he backed away to the minimum distance, only about a meter, to find out whether it was possible for a man to orient himself in the new conditions. During the later maneuvers the astronaut went away from the craft up to the maximum distance of the lead, some five meters. Leonov carried out all the movements in outer space in the same order as he had done during training. He went away from the craft backwards, but came up to the craft head first and with hands stretched forward, to avert any possible hitting against the craft. For his movement in outer space, the astronaut took orientation from the craft and the sun, which was either over his head or behind his back.

During one of the movements when pushing himself away from the craft, the astronaut started turning round. Stars started swimming before his eyes, then the view of earth's surface and the sun took the place of the stars. The turning slowed because of the lead. Although Leonov did not see the

craft, he knew exactly where he was. He judged his own position by the stars, the earth and the sun which were in his field of vision. The lead, when fully extended, was also a good orientator. The first experiment showed that man can fully orient himself in the unusual condition of free open space.

While in the open in outer space Aleksei Leonov did not experience any fear. He was confident about the reliability of the spacesuit and all the other equipment installed in the craft. This faith had been strengthened during the long months of flight training.

The second pilot while "swimming" in free space carried on telephonic conversation with the commander of the craft and with communication points on earth. Instruments installed in the cabin allowed Belyaev to control Leonov's pulse and breathing, and the working of his independent lifesaving system.

When "Voskhod–2" was flying over Siberia, Belyaev gave Leonov the command to return to the cabin.

Leonov was almost 24 minutes out of the cabin in the open; of this time he was freely "swimming" in outer space for 12 minutes.

After re-occupying his working place in the cabin the second pilot put down his impressions in the logbook. The astronauts started fulfilling the other part of their program. They carried out navigational experiments, which had been started by other "Voskhod" crews, they observed the meteorological processes in the earth's atmosphere and studied its optical characteristics. Belyaev and Leonov also completed a considerable volume of medical investigations and continued research on the vestibular apparatus.

The astronauts determined the threshold of sensitivity of the vestibular apparatus under oriented and unoriented positions of the craft. They carried out experiments connected with the reaction of man's nervous system to weightlessness.

According to the program, "Voskhod–2" was supposed to land on March 19 at 51 degrees north latitude. It was proposed to let the craft leave orbit during the 17th circuit, with the help of the automatic control.

While preparing for the landing, the astronauts noticed some deviations in the working of the system of orientation of the craft with reference to the sun. At the request of the crew, the mission control center allowed the commander to orient the craft with the help of manual control during the 18th circuit.

As is well known, all the previous manned spacecraft had left orbit for descent to the earth with the help of automatic instruments. Belyaev now carried out with his hands the prelanding maneuvers of the craft, i.e. its orientation in relation to the earth's surface. He switched on the engine to reduce flight speed. The craft left the orbit and at 1202 hours landed 180 kilometers away from Perm. From the time of takeoff till the moment of landing the flight continued for 26 hours 2 minutes. The astronauts felt fine.

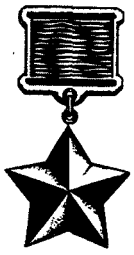
The flight of "Voskhod–2" with the second pilot's exit into the open in outer space showed that a man in a spacesuit with independent lifesaving system can live and work in outer space. The solution of the problem of vital activity and work of an astronaut outside the craft made it clear how great the possibilities are for a flight to the moon and other planets of the solar system and for creating manned orbital stations of national economic importance.

This brilliant sortie of "Voskhod–2" is one of man's greatest achievements on the path toward the conquest of outer space.

Vladimir Mikhailovich Komarov,
Twice Hero of the Soviet Union.

TASS ANNOUNCEMENT

On April 23, 1967, in the Soviet Union, a new spacecraft "Soyuz–1" was put by a mighty launch rocket into orbit as a satellite of the earth. The spacecraft "Soyuz–1" was manned by Hero of the Soviet Union, Engineer-Colonel, Vladimir Mikhailovich Komarov, Pilot-Astronaut of the USSR and a citizen of the Soviet Union. He had earlier performed an outer space flight in the "Voskhod" spacecraft.



"Soyuz"

For heroism, valor and bravery, shown at the time of making the test flight of the new Soviet spacecraft "Soyuz-1", Hero of the Soviet Union, Pilot-Astronaut Vladimir Mikhailovich Komarov is posthumously awarded a second Gold Star Medal. A bronze bust of the hero has been installed at his birthplace in Moscow.

FROM THE TASS ANNOUNCEMENT

The premature death of the distinguished astronaut and test-engineer of spacecraft, Vladimir Mikhailovich Komarov, was a heavy loss for the whole of the Soviet nation. V.M. Komarov devoted his life to the conquest of outer space for the sake of scientific advance, human progress and peace on earth.

His name will always serve as an example of heroism, valor and bravery. It will encourage other heroic deeds for the glory of our socialist motherland.

"I SEE A TESTER IN HIM..."

THE flags of the USSR and Union Republics were fluttering on their silvery masts near the Kremlin Palace of Congresses. They were raised in honor of the 23rd Congress of the Party.

Every morning we met delegates going to the regular meetings, at the Troitskie, Nikol'skie or Spasskie gates of the Kremlin, at Ivanov Square near the Czar-Cannon and Czar-Bell. Among them were astronauts as well. The communists of Moscow city sent Yurii Gagarin and Valerii Bykovskii to the Congress, while those of Moscow region elected Vladimir Komarov and Pavel Belyaev as their representatives. At the Altai party conference, German Titov was unanimously voted for, and from the Chuvash, Kiev and Kemerov parties, Andriyan Nikolaev, Pavel Popovich and Aleksei Leonov, respectively, were sent. Valentina Tereshkova got the mandate from her fellow-townspeople of Yaroslavl'.

The heroes of outer space came to the Kremlin from the "Star City", where their comrades in the detachment were continuing their studies and training.

The whole country was preoccupied with the congress, and so too was the detachment of astronauts. The revitalizing spirit of the Party Congress brought special elation into the routine life of the detachment.

... The fifth working day of the 23rd Congress of the CPSU had started. The leaders of the Communist Party of the Soviet Union and the foreign guests took their seats in the Presidium. A letter was received addressed to the congress by the scientists, designers, engineers, technicians and workers who had taken part in the creation and launching of the automatic station "Luna-10".

The presiding officer read it aloud:

"For the first time in the world a Soviet automatic station, 'Luna-10', has been successfully put in a selenocentric orbit and has become the world's first artificial satellite of the moon."

This report of the new victory of Soviet science and technology was simultaneously rendered into the mother tongues of the foreign guests by interpreters working in the synchronized translation booths. The hall resounded with applause. From the Soviet press lounge we could see how the astronauts fairly burst into applause. They, of course, understood exactly how much strength, energy and labor had been spent on the victory. The delegates congratulated the space heroes and shook hands with them. The pilot-astronauts were regarded as the representatives of those who had created and launched "Luna-10".

During the break we requested the astronauts to tell us something about the new experiment. We were particularly interested in Vladimir Mikhailovich Komarov's opinion. As an engineer he had, according to the proverb, all the cards in his hands.

"The creation of the world's first artificial satellite of the moon is the greatest achievement of space technology. It was very pleasant to hear from the rostrum of the congress that 'Luna-10' has gone into orbit around the moon. Like all the others, I heard the information about the new achievement with great pleasure."

"Is it difficult to send an object into orbit as a satellite of the moon from the technical point of view?"

"Accurate calculations, exactness of execution and high reliability of the instruments are essential for everything in space technology. Extraordinary apparatus is required for orienting the automatic station in outer space, for selecting the time of switching on the engines, for determining the strength of the engine impulse for carrying out corrections and at the time of reducing speed, while joining orbit as a satellite of the moon. It is known that 'Luna-10' started from an orbit as a satellite of the earth at a speed of about 11 kilometers per second. Gradually, as a result of known laws of celestial mechanics, this speed came down to approximately two and a half kilometers per second. But even at this speed an object will not stay put near the moon,

Yu.A. Gagarin, V.M. Komarov, S.P. Korolev and V.M. Keldysh.

but will tend to become a satellite of the earth. However if the speed dropped, the moon would 'catch' the object and it would fall on to the moon's surface."

"What speed is needed for staying in lunar orbit?"

"The scientists calculated that 'Luna-10' could join the trajectory of a lunar satellite with a hyperbolic orbit as a result of reduction of speed to 1.25 kilometers per second. The flight along the orbit would take about three hours.

"As can be seen from all these conditions it was necessary to do a lot, so that 'Luna-10' would act according to man's desire."

Vladimir Komarov stressed: "The new experiment in outer space has once again confirmed that the Soviet Union is capable of producing automatic stations equipped with perfect instruments and devices, which can guarantee fulfillment of complex outer space experiments."

The astronaut expressed his readiness to take part in such experiments. Engineer-Colonel Komarov, an assistant at the Academy, well remembered the words of the great Russian scientist N.E. Zhukovskii: "Man will fly depending not on the strength of his muscles, but on the power of his intelligence." Komarov studied earnestly. He had to take the most serious examination in October 1964 when he flew in the "Voskhod" craft along with Konstantin Feoktistov and Boris Egorov.

Sergei Pavlovich Korolev held Komarov in high esteem. Once talking to

the president of the State Commission the scientist said that he had set great hopes on Vladimir Mikhailovich.

"If you want to know why," said the designer "then I see in him a competent tester of manned craft."

In the story of the astronaut's life there are many examples of his persistence and bravery in achieving his aims.

"Not to search for an easy way of life, but by continuous labor to work for the benefit of the people: this gives permanent happiness." This was the theme of Komarov's life.

Komarov came to the detachment of astronauts along with other pilots a year after graduating from the Academy. He was nominated Popovich's double, and if necessary would have flown on the "Vostok-4" craft. Vladimir Mikhailovich helped Titov and other members of the detachment a lot.

And then he became the leader of the "Voskhod" crew. On Columbus' Day when the 472nd anniversary of America's discovery was being celebrated in the USA, the Americans joked that the Soviet astronauts Komarov, Feoktistov and Egorov had stolen the laurels of the famous explorer, for it was exactly on this day that "Voskhod" was launched. Commenting on the flight, the astronaut Scott Carpenter exclaimed: "I would not have been surprised if two people had been sent up: but three—yeah! That is a great feat. It seems the Russians always do what we least expect."

It was natural that already in those days a new spacecraft, "Soyuz", was being born, and still nobody knew who would become its first tester.

At the time of the 50th anniversary of the Soviet State and the tenth anniversary of the launching of the first Soviet artificial satellite of the earth, the journalists asked the astronauts four questions:

1. Which event in the space era was most pleasing to you?
2. What type of training do you like most and what do you think is its most important part?
3. What scientific subject in the program of study interests you most?
4. How do you propose to celebrate the 50th anniversary of the Great October Revolution?

Vladimir Komarov answered:

1. I will never forget the day when I was appointed commander of the "Voskhod" crew. A dream had come true. The flight itself, the joint work with Konstantin Petrovich Feoktistov and Boris Borisovich Egorov was also memorable. The happiness of meeting after the flight at the cosmodrome and in Moscow is unforgettable.

2. The most interesting and important part of our work connected with flight preparation is the training to control the spacecraft, its systems and instruments.

3. The work connected with the preparation for the flight, the meetings

In thoughtful mood.
Vladimir Mikhailovich Komarov
and German Stepanovich Titov.

with the engineers and designers of the outer space flying apparatus and their systems, attract me most.

4. I would like to celebrate the 50th anniversary of the October Revolution with such success in my work that I could honestly tell myself: "I have done everything possible, everything within my powers, everything of which I am capable."

Commenting upon Vladimir Mikhailovich's nomination as commander of the "Soyuz-1" craft in April 1967, Yurii Gagarin observed:

"In my opinion, it is very good that the accomplishment of such a difficult task has been given into the hands of Komarov. The selection is very apt. He is a highly qualified and excellently trained astronaut. It is necessary to stress that he will be carrying out the program not only as a pilot-astronaut, but also as a person who has become a specialist in his field during only a few years of space training. The space engineering profile has become a profession for him. In view of the nature of the present task, this detail is very important."

In a statement before the start, Komarov expressed how honored he had felt to be first to be asked to test the new craft in flight.

The flight of the "Soyuz-1" spacecraft started on April 23, 1967. The craft joined orbit as a satellite of the earth at 0335 hours. It was envisaged to test the new manned spacecraft, its systems and elements of design and carry out scientific, technological and medico-biological investigations.

"Soyuz-1" was put in an orbit near the calculated one with the parameters: apogee 224 kilometers and perigee 201 kilometers.

The period of completing one circuit around the earth was 88.6 minutes; its inclination was 51 degrees 40 minutes.

During the test flight, which continued for over twenty-four hours, V. Komarov completed the full and complex program of testing the systems of "Soyuz-1". He also carried out the planned scientific experiments. The astronaut accomplished maneuvering in near-earth outer space, tested the basic systems in various conditions and evaluated the technical characteristics of the new spacecraft.

On April 24, when the testing program was completed, Komarov was asked to stop flying and land. The astronaut carried out all the operations connected with the changeover to the descent trajectory. After separation from the other sections, the recovery capsule passed through the region of reduction of speed in the thicker layers of the atmosphere and the initial outer space speed was checked. However, in the next stage the apparatus came down with an intolerable speed, since the parachute system did not work. As a result, the life of the astronaut V.M. Komarov was tragically cut short.

The name of Vladimir Mikhailovich Komarov, distinguished astronaut and tester-engineer of spacecraft, will live forever in the heroic annals of the study and conquest of outer space.

NEW AIMS— NEW CRAFT

MANY basic problems of space conquest were resolved in the years 1961–1965.

The flights of the spacecraft "Vostok" and "Voskhod" opened wide perspectives in the study of the earth and near-earth outer space: the resolution of a complete set of applied problems important for the national economy; the possibility of studying the sun, moon and planets of the solar system; and the path to the development of interplanetary flights in the future.

Now what was needed was a new multipurpose craft. It would have to master operations in outer space which are of special importance for the construction of orbital stations and interplanetary craft and at the same time carry out a wide variety of scientific investigations for the needs of the national economy. The Soviet scientists and engineers thought that the creation of orbital stations with changing crew would be a milestone on man's journey to outer space.

The spacecraft "Soyuz" belongs to this new type of flying apparatus. It

was meant for the mastery of operations in outer space related to the assembly of orbital stations and the organization of its supplies. The following scientific problems were also posed for solution by the "Soyuz" craft: comprehensive investigation of the earth and its atmosphere from the geophysical, radiophysical and space navigational points of view; the study of questions connected with the scientific utilization of conditions mainly prevalent in near-earth outer space (complete vacuum, weightlessness, radiation); observations of the sun, stars and planets from outside the atmosphere.

A new stage in the development of manned spacecraft technology started with the creation of the multiseater "Soyuz."

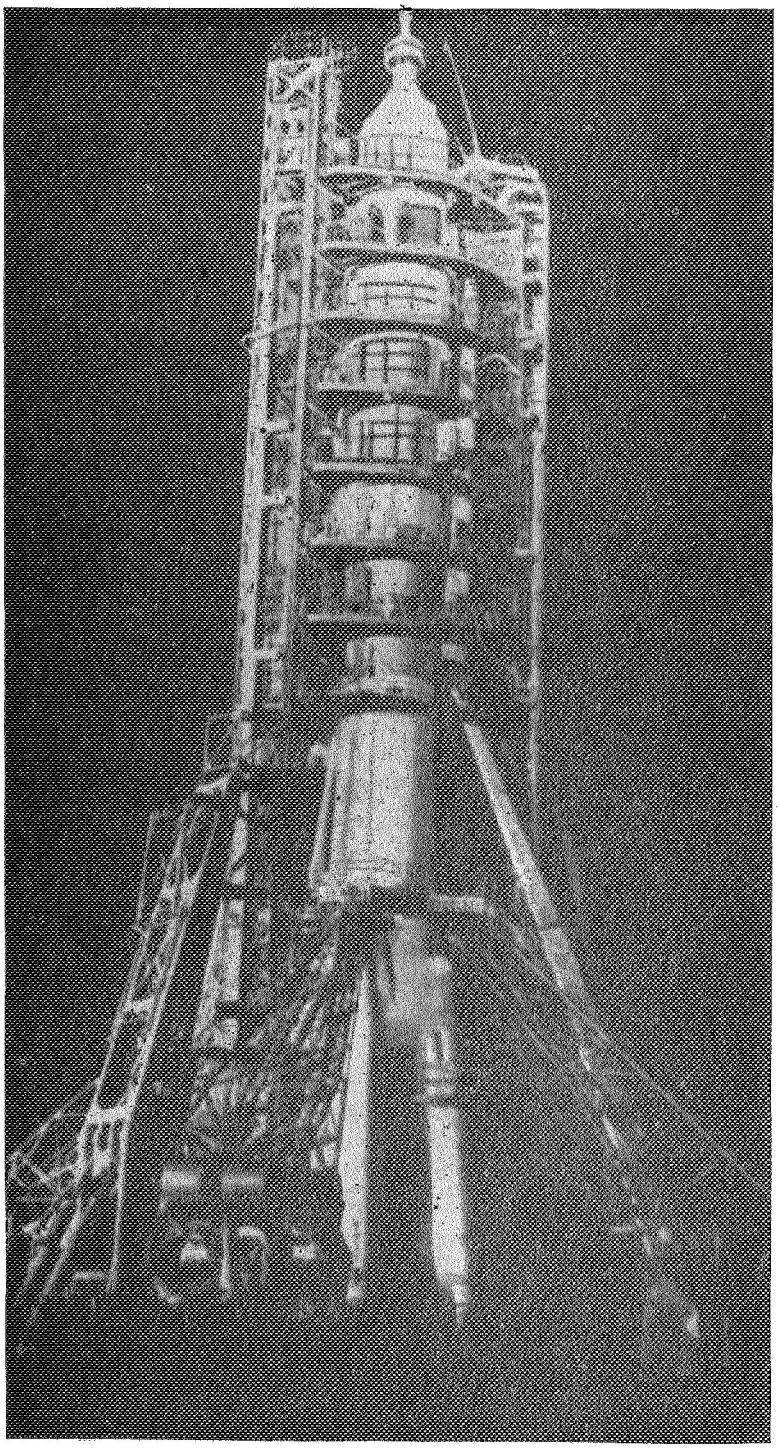
"Soyuz" consists of the astronauts' cabin (the recovery capsule), and the orbital instrument and systems compartments. The craft weighs about 6,575 kilograms. The craft has two compartments for living in, the astronauts' cabin and the orbital compartment for scientific experiments, rest and exit into open outer space. It also has on board systems and engines of various denominations for wide maneuvering in outer space, and scientific instruments.

These features of the "Soyuz" craft permit the carrying out of diverse scientific-technological and medico-biological experiments, investigations and observations.

The crew stays in the cabin at the time of launching, maneuvering in the orbit and descent toward the earth. The astronauts' seats, the control panel, means of radio communication, apparatus for safeguarding the vital activities and the system for controlling the descent are fixed here. The main and reserve parachute systems are placed in containers. The craft control panel is situated right in front of the pilot-commander. On the panel there are instruments for controlling the working of systems and units, navigational equipment, a television screen and switches for controlling the board systems.

Next to the panel there is an optical orientation sight on a special porthole. On the right and left of the pilot's seat there are two control handles. On the starboard and port sides there are portholes for visual observations, shooting movie films and taking stills. Containers with the supply of food and water are placed in the cabin. The cabin is covered on the exterior with a coating of thermal protection. Low-thrust rocket engines for re-entry control and engines for soft landing are mounted on the cabin body. The astronauts' cabin is connected to the orbital compartment by an airtight hatch.

The orbital compartment is a laboratory for observations and investigation of outer space, and a place for the astronauts' rest and recreation. It also plays the role of an airlock chamber at the time of their exit into open space and return to the craft. The units of the lifesaving system, apparatus for controlling and communications, scientific instruments, telecamera, movie and photo cameras, spacesuits, edibles, first-aid kit and objects of hygiene



The spacecraft "Soyuz".

are kept in the orbital compartment. The compartment has four portholes.

The total internal area (volume) of the recovery capsule and the orbital compartment is nine cubic meters. Thanks to the high degree of reliability and hermetization of the design at the time of flight, the astronauts stay here in light dress without spacesuits.

The main apparatus on board and the engines are placed in the instrument and systems compartment. The units of thermoregulation and electric supply systems, apparatus of long distance radio communication and radiotelemetry, instruments for orientation and movement control with the computer are all concentrated in the pressurized instruments' section. The non-hermetic section has the impellant plant, which includes two liquid-fuel jet engines: the main and the double with a thrust of 400 kilograms each. The impellor arrangement is meant to carry out corrections in the craft's orbit with changes in apogee up to 1,300 kilometers; to bring two craft nearer one another at the time of meeting, and to reduce the speed for leaving the orbit at the time of return to the earth.

For turning the craft at the time of maneuvering near a second craft, a system of low-thrust engines has been fitted in the compartment. A radiator for thermal regulation, orientation sensors, panels of solar batteries with a useful area of 14 square meters and antennas of the radio systems are also fitted on the outer side of the instrument and systems compartment.

The craft is defended from the action of aerodynamic and heat loads during the takeoff for orbit by the head fairing. During this period the panels of solar batteries and antennas are in a folded position. The fairing is thrown off after passing through the thick layers of the atmosphere.

The "Soyuz" is controlled with the help of the orientation and motion control system. The system can work automatically, as well as by manual control, and includes: infrared and optical sensors of orientation, the optical sight—the astronauts' orientator, gyroscopic instruments and electronic computers, radio-technological apparatus for location and direction, the system of executive parts of the micro-engines and two handles for controlling the craft. One handle is for controlling the linear movement of the craft, the other for controlling the turns.

The astronaut uses the optical sight and the external telecameras while controlling his craft at the approach stage.

The astronaut gets the information about the relative distance and speed of approach on the indicators, fixed on the control panel. For making the common orientation easier at the time of maneuvering in the process of approach, the "Soyuz" craft are furnished with orientators and color beacons. A centralized system of electric supply provides electrical energy to the apparatus on board.

The complex of radio-technological means ensures the determination of orbital parameters, the receipt of commands from the earth, two way radio

telephone and telegraphic communication with earth on various wavelengths, the transmission to the earth of television pictures from the compartments of the craft and of the external situation being observed by the astronauts. The television system on board has four cameras (two in the craft's compartments and two on the exterior) and is capable of sending pictures directly to the television network on earth.

The "Soyuz" craft are fitted with an automatic docking system. At the time of flight, when there is no need of docking with another craft, the docking system is removed. The astronaut controls the systems on board from the panel, or this is done automatically, at commands from the earth.

Normal physiological-hygienic conditions for the crew ensure security of life. The regeneration system works automatically and maintains a gas composition in the manned compartments like that of the atmosphere on the earth's surface. This system absorbs the harmful admixtures secreted by man in the atmosphere. The thermoregulation system maintains the necessary temperature and humidity in the compartments. The astronauts can regulate the level of temperature and humidity in the cabin and in the orbital compartment, if they so desire.

The instruments of the craft permit complete independence of flight without commands from the earth. The length of the flight is determined by the program of a concrete flight and the corresponding supplies of food, water and capacity of the regeneration system. It is possible to make flights of up to 30 days in "Soyuz" craft. The design of the spacecraft ensures the safety of the crew under conditions of cosmic radiation.

The craft is oriented in outer space and the retrorockets for returning the crew to the given region are fired either automatically, or by the astronaut. During the engine equipment's working the speed is reduced to 7.7 kilometers per second, and the craft starts moving toward the earth. At a calculated time the recovery capsule separates from the adjacent compartments at a command from the program timing equipment; after that the system of controlled descent goes into action.

The principle of descent with utilization of aerodynamic lift has been employed in the design and control system of the recovery capsule, due to which the high gravity pressure on the crew is reduced to 3-4 units (as compared to 8-10 units during ballistic descent). Besides, the accuracy of the recovery capsule's landing is considerably increased due to the application of aerodynamic lift. The control system of the recovery capsule works completely independently. The system controls the trajectory of descent during the apparatus' movement in the thick layers of the atmosphere.

It is possible to come down in the atmosphere along the ballistic trajectory as well. For smooth descent after reduction of speed in the atmosphere, the

parachute system comes into operation at the height of about nine kilometers. Just before landing, at the height of about one kilometer—the gunpowder engines for soft landing start working. The working of the whole landing complex is controlled automatically.

Georgii Timofeevich Beregovoi,
Twice Hero of the Soviet Union.

TASS ANNOUNCEMENT

On October 26, 1968 the spacecraft "Soyuz-3" was put into orbit by a mighty launch-rocket as an artificial satellite of the earth.

The spacecraft was manned by pilot-astronaut Colonel Georgii Timofeevich Beregovoi, Hero of the Soviet Union, Honored Test Pilot of the USSR, and a citizen of the Soviet Union.

"Soyuz-3"

For making an outer space flight in the spacecraft "Soyuz-3" and for showing bravery and heroism, Hero of the Soviet Union, pilot-astronaut Georgii Timofeevich Beregovoi is awarded the Order of Lenin and a second Gold Star Medal. A bronze bust of the hero has been installed at his birth place.

* * *

For making an outer space flight in the spacecraft "Soyuz-3" the title of the "Pilot-Astronaut of the USSR" is conferred upon Georgii Timofeevich Beregovoi, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

Georgii Timofeevich Beregovoi was born on April 15, 1921, in Fedrovka village in the Karlovskii district of Poltava region. His childhood was passed in Enakievo city.

Georgii started working in a metallurgical factory at the age of seventeen, after finishing eight years in secondary school.

In his youth Beregovoi was attracted by aviation and after graduating from the aeroclub he joined the Lugansk School for Air Force Pilots in December 1938.

From the very first days of the Second World War he was sent for active service. He saw action in fighter squadrons on different fronts.

In August 1943 Georgii Timofeevich became a member of the CPSU.

After the war he graduated from the higher school for officers, and completed courses for test pilots. Since 1956 he studied in the Yu.A. Gagarin Air Force Red Banner Academy while continuing his work.

G.T. Beregovoi is a Hero of the Soviet Union, and has received several awards and medals.

From 1948 till 1964 he was a test pilot and was awarded the title of the "Honored Test Pilot of the USSR".

In 1964 he was enlisted in the detachment of astronauts.

MASTER

"Colonel Beregovoi is ready for the flight!"

These words of the report to the president of the State Commission rang out on the morning of October 26, 1968.

The commander of the "Soyuz-3" craft was standing in a sports outfit: a light blue jacket, gray trousers, and a peaked cap. It seemed their owner was an inveterate automobile lover and was going on a regular drive.

When the mighty launch rocket lifted "Soyuz-3" into orbit as an artificial satellite of the earth, we started recalling what we knew about Beregovoi, and under what circumstances we had first met him.

...Two days after the world came to know of Yurii Gagarin's name, a decree of the Presidium of the Supreme Soviet of the USSR was published in the newspapers. The title of "Honored Test Pilot of the USSR" was conferred upon a large group of test pilots. Georgii Timofeevich Beregovoi was among them.

And the first meeting. Pilots were walking along the Red Square towards the Spaskii Gate of the Kremlin. The officers guarding the entrance to the

government buildings saluted with special solemnity. In this manner they show their respect for these people who have already flown hundreds of difficult sorties, who have faced and battled with the unknown, who are engaged every day in the struggle to put into operation new aircraft, born out of the labor of designers and workers.

The pilots go up the stairs to the second floor. The investiture ceremony is to take place in the conference hall of the Presidium of the Supreme Soviet of the USSR.

The hall is small and rectangular. In the center is a long table with chairs. There is a tall clock with a pendulum. Everything is very simple, austere.

The recipients of awards are requested to take their seats near the table. The pilots are in ceremonial military uniforms. The Gold Stars of Heroes and other medals glitter.

The president of the Presidium of the Supreme Soviet of the USSR L.I. Brezhnev enters. The decree is read out. While presenting the medal and diploma of Honored Test Pilot, Leonid Il'ich Brezhnev warmly and heartily congratulates each recipient.

"Colonel Georgii Timofeevich Beregovoi!"

A tall military officer stands up. On his tunic there is the Gold Star of Hero of the Soviet Union, battle orders and medals. His face is manly, handsome, with wide eyebrows and dark hair. If you were to see him once, you could never forget him.

"I am highly pleased to present you the award. I congratulate you, Georgii Timofeevich," says Leonid Il'ich, "I wish you good health and further success in flying."

The Colonel received the small box containing the medal with the diploma and expressed his thanks.

His comrades applaud Beregovoi, and when he resumes his seat they shake his hand and congratulate him.

The whole process of investiture to one pilot did not take more than a minute. The press photographers and movie operators shot the scene. If only the journalists present in the hall could have guessed that here before them was a future astronaut! But then, we did not know either German Titov, or the other future outer space heroes. Georgii Beregovoi also didn't know them. He did not join the astronauts' detachment till three years later.

Beregovoi at this time was for the correspondents a famous test pilot and people of his heroic profession always attract the journalists' attention.

How did Beregovoi's destiny take shape?

"He can fly on anything that is capable of leaving the earth's surface," said one of the pilots about his friend on the battle front. These words, pronounced in a semi-humorous tone, have something in common with a famous dictum of pilots: "A test pilot must fly in everything that *can* fly, perfectly; and also a bit in things that can't fly!"

"Fly in everything"...G.T. Beregovoi spent all the war years in active service.

A decree of the Presidium of the Supreme Soviet of the USSR signed by M.I. Kalinin was published in the "Pravda" newspaper of October 27, 1944. In the decree proclaiming the award of titles of Hero of the Soviet Union to the officers of the Red Army Air Force, the fourteenth name was that of the Guard's Captain G.T. Beregovoi. "For exemplary fulfillment of battle missions of the Command at the war front against German occupation forces and for showing valor and heroism in this task..."

Fierce battles were in progress on the land and in the air. The fighters with red stars went up to meet the "Junkers" and "Messerschmidts". Our bombers raided the enemy forces, fortifications and strategic objects. At times scores of aircraft took part at one and the same time in dog fights. The might of our aviation was constantly growing, its punches were becoming stronger and stronger.

The fighter pilots made a profound contribution towards our victory. The aircraft IL-2, with its powerful cannon-machinegun armament, became a terror to the Nazis and was named by them "the black death".

The young pilot Georgii Beregovoi sat behind the control column of this aircraft. He flew on 184 battle sorties. The fighter annihilated land forces, enemy fortifications, and carried on its fight in the face of strong anti-aircraft fire, and in aerial contact with fighters and bombers. It would be worthwhile to describe every one of these sorties in detail. But pilots do not like to go into details, and hence refer to them as military affairs. Beregovoi is no exception.

Where Beregovoi's craft passed, only heaps of metal remained of enemy equipment. It happened near Pzhev and Velikie Luki during the days of the battle on the Dnieper and again at the time of freeing Kiev, Volyn', L'vov... And it continued to happen during the period of the fight to free Poland, Rumania, Hungary and Czechoslovakia.

On May 9, 1945 Captain Beregovoi with his squadron was still bombing the Nazi units which refused to lay down their arms. This was his 185th strike sortie. With this sortie Beregovoi completed his front line biography. The motherland recorded his feats of arms with the Gold Star of Hero of the Soviet Union, the Order of Lenin, twice the Order of the Red Banner, the Orders of Aleksandr Nevskii and Bogdan Khmel'nitskii, twice the Order of the Red Star of the Patriotic War and other medals.

During the postwar years, when some comrades of Beregovoi left aviation, he understood that for him there was no life without an aircraft, without all that we call aeronautics.

"The path to the sky lies through knowledge and persistent labor," said the pilot. This became his motto during his years of work as a test pilot.

Once we asked astronaut Beregovoi just by the way:

"When did you have the most satisfying moments in your life?"

Georgii Timofeevich answered:

"Those moments are connected with flying. When a heavy motor would get out of control, and then would surrender to experience, willpower—this brought happiness. I had several such moments. Every new aircraft is a joy to a test pilot."

"If every test of a new machine is a joyful day for you, then how many such days have you had?"

"More than fifty."

There were several different events in the life of the test pilot. A test was always waiting for him; everything to be faced for the first time, including a lot of unknown things.

"I flew and at times took risks, but for the sake of the job, not from sporting interest," said Beregovoi. "The tester's work is useful to the people. And for this reason one can take up the most difficult and risky tasks..."

Let us hear from one of those who worked together with Georgii Timofeevich. Air Force Major General A. Molotkov, Honored Test Pilot of the USSR, narrates:

"The tests of a supersonic fighter-interceptor went sufficiently successfully, but it followed from Beregovoi's observations that a dangerous situation could arise under certain conditions of flight. I had to fly immediately to the testing ground. On landing, I taxied over to the parking place of the sleek silvery craft. Specialists had clustered around one of them. It meant Beregovoi's flight would take place. I enter a small house behind the hedge, gray with dust.

"There are three people in the retiring room. Aleksandr Shcherbakov was stretched on the bed, Vladimir Il'yushin was sleeping near the window. Georgii Beregovoi was sitting at the table. Before him there was a model of one of the devices. The pilot was looking thoughtfully at the dial with moveable hands.

'You are experimenting?'

'Well, you see,' answers Beregovoi, 'I want to suggest a new system of indicator equipment. Look what happens...'

"Georgii explained the principles in detail. His evidence, inspired by the wish to make the flight of an ordinary pilot simpler and safer, seemed convincing. The capacity to evaluate technology from the position of the 'mass consumer', the ability to search out the most hidden defects, and critically assess one's own impressions—all this is what makes a test pilot a man of really golden qualities..."

Georgii Beregovoi is by right famous as a master of test flights. As far back as the beginning of the fifties he was appointed chief test pilot of the all-weather, as they were then called, interceptors. They had a complex apparatus fitted on board the aircraft to search for unseen air objects in the clouds,

both during the day and at night. And Beregovoi coped with his task brilliantly.

Cool calculation is an exclusive property of a tester. But it does not come at once. At the beginning of the fifties Georgii Timofeevich had the opportunity to acquire this great quality.

In accordance with the program for testing a device fixed on the arrow-like MIG, it was necessary to carry out a number of dives for obtaining photographs of an agreed object on the earth. The success depended on the steepness of the dive and to the exactness of the trajectory.

Georgii Timofeevich got increasingly better results from each succeeding flight. But the over-particular leading engineer demanded still more accuracy. The pilot also was no less meticulous and threw the aircraft into steep dives dozens of times...

The calm, confident tone of preflight preparation heard at the round table left no doubt that the pilot had thought over carefully all the stages of the test flight.

"What to do if the engine cuts during flight?" asks Georgii. "I shall restart it. If everything is done according to the determined order, the engine will definitely restart. I have already tested it several times. The important thing is to retain confidence, even if the first trial is unsuccessful."

"Georgii Timofeevich, maybe we will put the flight off till tomorrow?" I put this provocative suggestion knowing beforehand what the answer would be. "According to my view the weather is not very favorable for flying—there are clouds up to almost 10 thousand meters."

"So what! you know I shall be only looking at the instruments."

"Comrade Colonel, the aircraft is ready for flight!" reported a technician.

"O.K.," answered Georgii Timofeevich. "I am coming."

* * *

One of the flights in a supersonic fighter-interceptor proved to be quite troublesome for Beregovoi. At its maximum height in the stratosphere, the engine failed.

Without speed and without lift the aircraft turned into a freely falling piece of metal. Beregovoi soberly took stock of the situation and... made his decision. Utilizing the speed of the fall, the pilot brought the machine into a horizontal flying position for some time and selected the speed at which the engine could confidently be expected to start working.

If in this instance Beregovoi remained the boss of the situation and felt that the aircraft had obeyed him without demur, on another occasion it was the other way round. In the midst of carrying out a flight-schedule the tester felt the control jam and the aircraft start losing height at the rate of 20–30 meters per second. What to do? Bail out and leave the new machine? No!

The aircraft must undergo all the tests, must earn the right to live. It had already proved its wonderful qualities.

The earth was several kilometers below. There was still time to struggle. The fight must take place! More and still more. The sweat streamed from his face, his back was wet with the effort.

But with no result. The control handle had only moved a few millimeters. Another jerk! A second, third... The handle had moved a little more. Finally it worked. The aircraft was not out of control any more. But the control handle was still not working properly. The seriousness of the situation was felt as keenly on the ground. But nobody made any suggestions. Only the pilot himself can take the correct decision. And the decision was found—by controlling the speed of descent with the help of the gas sector, by increasing and decreasing the revolutions.

When Beregovoi landed, the ambulance and fire engines rushed up to him. But the help of the doctors and firemen was not required.

"Everything is in order," reported the tester to the chief designer. "Though, something is *not* in order with the stabilizer..."

Some details were modified. The aircraft received its clearance signed by the same person who first took it off the ground.

When Georgii Timofeevich joined the astronauts' detachment, he had the experience of hundreds of hours spent in solitude with new machines to back him. He had graduated from the Air Force Academy. Now in front of him was the challenge of outer space.

It is interesting that Beregovoi had met Sergei Pavlovich Korolev, before the start of his space training, and even before he made his request for enrollment in the detachment. The Academician was interested in Beregovoi's suggestions concerning the construction of spacecraft and their control, in particular in the reciprocity of automatic systems and the pilot-astronaut. It was then that Georgii Timofeevich told the chief designer about his dream to become an astronaut, but lamented that his age was against him.

"Age is not an obstacle," answered Sergei Pavlovich. In astronautics, as in everything else, what is needed is a judicious combination of youthful energy and experience.

* * *

... Our meeting with Georgii Beregovoi in the "Star City" took place in 1966, two years after the pilot had found a new job and a new place to live.

A few minutes before our conversation with Beregovoi, we had a short talk with Gagarin. Yurii Alekseevich had the habit to give a short reference before introducing anyone from the detachment. This time he said:

"Very interesting man, a pilot with a capital P. When I had just started school, he was already raiding the Nazis."

G.T. Beregovoi at training.

"How old is he?"

"What does it matter? In our detachment there is no other pilot with higher technological grounding than Georgii Timofeevich. Please listen to his opinion about the place of man in mastering space technology. Many aircraft designers whose machines he tested are friendly with him and have a high opinion of him." Then after a pause, "I am going, make use of my room, nobody will disturb you here." And collecting a pile of new letters from his table, said, "I will send him to you just now."

...A tall pilot entered the room and introduced himself as Beregovoi. He at once added, "Excuse me for not talking about my life. The details are uninteresting and dull. About everything else I can talk with pleasure."

We made use of Yurii Alekseevich's advise and started the conversation with technology:

"In the recent past the voices of engineers are heard clamoring, trying to bring down the level of man to an appendage of technology, a mere servant of the almighty automatic machine. What do you think about this?"

"Academician Korolev gave the automatic machines their due," said Beregovoi, "but emphasized that in outer space flights the pilot must control the technology. The psychological factor should also be taken into

account. A man feels much more confident when he knows that the success of the experiment depends on him.

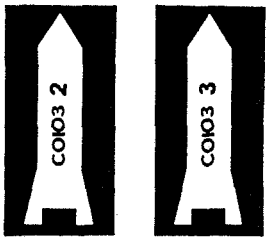
"It seems to me that the flight of Pavel Belyaev and Aleksei Leonov in 'Voskhod-2' eloquently speaks in defence of the 'rights' of man in outer space. As is well known, during the final stage of the flight the commander of the craft utilized the manual control landing.

"A second example—Aleksei Leonov was the tester of the airlock system for exit into open space and of the special spacesuit. In the near future man will require the capacity to work outside the craft, accomplishing earthly tasks in outer space. Konstantin Eduardovich Tsiolkovskii wrote about this long ago, Sergei Pavlovich Korolev also talked a lot about it. The workers and specialists will have to participate in the assembly and repair of outer space stations; therefore exit from the craft and travelling from one craft to the other will become an ordinary affair."

"For the time being space technology must be worked out in stages. Tomorrow or the day after it will be under the command of the astronauts. A difficult but worthwhile honorable task stands before the testers of new space technology. Now this has become the aim of my life."

...After completing his "Soyuz-3" flight Georgii Beregovoi said at the meeting in the Kremlin Palace of Congresses:

"The flight program was difficult and saturated. In accordance with the set task the 'Soyuz-3' craft went near the unmanned craft 'Soyuz-2' and maneuvered in outer space. I as an astronaut-tester have no complaints about the working of the systems on board the craft: they are comfortable in handling, effective and reliable."



AUTOMATIC DEVICES DOCK IN OUTER SPACE

The docking of space apparatus in orbit is one of the most important operations in outer space travel. The flights carried out in the USSR proved the feasibility of docking and paved the way for working out a number of systems and technical means for ensuring the success of the operation. This operation will become an essential element in several outer space flights in the future; for example, at the time of assembly and servicing of orbital stations, assembly and refueling of heavy interplanetary crafts, saving spacecraft crew and orbital stations at the time of mishaps and emergencies, supplying the necessary materials to the orbital stations, changing and repair of satellites and so on.

At the time of docking of space apparatus, one remains inactive and is called passive. The second which is entrusted with the greater part of the docking maneuvers is called active.

The operation of docking and linkup in orbit can be divided into the following stages: the stage of launching into the zone of docking, the search and "catching" of the passive apparatus by the detection mechanism on

board the active apparatus (mutual search and "catching" is also possible), the approach, docking and linkup.

For meeting the passive apparatus, the active is launched with the help of a command and measuring complex on earth, which determines the sequence of its maneuvers.

The task of the approach stage is to reduce the relative distance between the two apparatus down to tens or hundreds of meters and the relative speed down to a few meters per second or even down to a fraction of a meter per second. This problem is solved by the approach systems on board the craft.

If during the approach stage the passive apparatus is apprehended by the radio locators on board as a dot-like source of radiation, to the astronaut it simply looks like a shining point, almost indistinguishable from the surrounding stars. At the docking stage the geometric dimensions and form of the space apparatus can be distinguished. Then its orientation also acquires importance.

The docking units of the spacecraft are situated in a definite direction, therefore one must come up to the other from a definite side and, of course, at a very slow speed. The docking units are very complex mechanisms. Their job is to absorb the shock of the initial collision of the apparatus and join them at first in such a way that they cannot easily slip away from each other, and then firmly, with the linking up of electrical contacts.

The docking and linkup of space units in orbit can be carried out automatically, as well as with the astronaut's participation. For solving several problems of astronautics automatic linkup is necessary since it permits considerable simplification of the spacecraft in comparison to the manual linkup. For example the lifesaving system can be done away with and the load factor requirements, as well as the reliability of the systems, can be reduced.

Soviet specialists carried out the first automatic docking and linkup in orbit of two artificial earth satellites. The satellites, "Cosmos-186" and "Cosmos-188" were automatically linked up on October 30, 1967. The satellite "Cosmos-186", which played the role of active apparatus at the time of docking and linkup, was launched on October 27, at 1230 hours Moscow time.

During the first three days of the satellite's flight the working of the systems and engines on board was tested and the craft was maneuvered to correct its orbit. On October 29, the orbit of the satellite was corrected so that on October 30 it passed over the launching site of "Cosmos-188" which was ready for firing.

The passive apparatus "Cosmos-188" was then launched. Its launching time was selected so that after separating from the launch rocket, "Cosmos-188" was left in the docking zone with "Cosmos-186". The distance between he satellites before the start of approach and linkup operations was 24

kilometers, and their relative velocity was about 25 meters per second.

After the satellites carried out mutual search with the help of radio detection systems, their approach started. The engine unit, meant for orbit correction and approach, worked so that the satellites approached each other up to a distance of about 300 meters. The later approach and docking was carried out by using low-thrust engines. At the end of the docking stage the relative velocity of the satellites came down to 10–50 centimeters per second, which allowed joining almost without any jerk. Besides, at this stage the relative angle of heel, i.e. the angle between the vertical planes of the satellites, came down to zero. This angle was measured by a special radio location sensor.

If the relative angle of heel is brought down to zero, then every linkup pin of the one satellite can slide into the corresponding socket of the other satellite.

The automatic linkup of "Cosmos-186" and "Cosmos-188" was accomplished on October 30 at 1220 hours. The satellites formed one united complex which continued flying for 3 hours 30 minutes. At 1550 hours, at a command from the earth, the apparatus separated.

The process of search, approach and linkup was completed outside the zone of Soviet radio visibility. It was registered by telemetric systems, recorded in memory units and transmitted to stations on earth at the time of the linked up complex's presence in the radio visibility zone. Television pictures of the apparatus joined together were received on the earth. The process of separation took place over Soviet Union territory and was observed by television at the measuring points.

"Cosmos-186" completed its outer space flight and soft-landed in a given area at a command from earth on October 31. "Cosmos-188" continued flying for another two days and after completing the planned program was returned to earth on November 2.

The experiment of automatic docking and linkup in orbit by two space apparatus was repeated on April 15, 1968 with the satellites "Cosmos-212" and "Cosmos-213". Their joint flight lasted 3 hours 50 minutes. During this period the systems and units of the satellites were tested. The delinking of the apparatus was carried out at a command from the earth and was observed on television. After some time the satellites were transferred to different orbits and continued their flights for four more days. At the end of the planned program of experimental research, "Cosmos-212" and "Cosmos-213" returned to the earth on April 19 and 20.

As a result of the experiments with "Cosmos" satellites "186–188" and "212–213", a scheme of launching successive apparatus into orbit one after the other from one or two launching sites of the cosmodrome, was worked out. Under these conditions, at the time of its joining the orbit, the second apparatus would be in the meeting zone very near the first one. Besides,

the automatic system of controlling the meeting and linkup, which was later incorporated in the "Soyuz" craft, was worked out and tested during these flights.

Because of the successful experiments on automatic docking and linkup in outer space, the Soviet specialists could proceed in real earnest to solve such problems as that of manual control for the maneuvering and approach of spacecraft and their launching in orbits near each other.

MANEUVERING IN ORBIT

The unmanned craft "Soyuz-2" was launched into orbit as an artificial satellite of the earth on October 25, 1968 for experiments in maneuvering with another spacecraft. The parameters of the craft at the beginning were: period of completing the orbit—88.5 minutes, apogee—224 kilometers, perigee—185 kilometers, angle of inclination—51.7 degrees.

When "Soyuz-2" was flying over the Baikonur cosmodrome area, "Soyuz-3" manned by Pilot-Astronaut Georgii Timofeevich Beregovoi, blasted off at 1134 hours on October 26. "Soyuz-3" was launched into an orbit near the calculated one, with the parameters: period of completing the orbit—88.6 minutes, apogee—225 kilometers, perigee—205 kilometers, inclination—51.7 degrees.

The main aims of Beregovoi's flight were: the mastery of the process of approach and maneuvering with the aid of the orientation and control systems of the craft, the mastery of means and methods of astronavigation, the carrying out of a wide complex of scientific-technological and medico-biological experiments.

After parting with the last stage of the launch rocket, "Soyuz-3" was in the docking zone and carried out radio search and the "catching" of "Soyuz-2" and then began approaching it. The automatic system carried out the stage of approach up to a distance of 200 meters. The astronaut had only to supervise the working of automatic machines. But Beregovoi himself by utilizing the manual control system, conducted the subsequent maneuvers for approach up to a distance of a few meters. After this "Soyuz-2" and "Soyuz-3" separated from each other up to a distance of 565 kilometers. The approach operation was repeated on October 27. On October 28, "Soyuz-2" soft-landed in a given region of the Soviet Union after completion of the experiments.

Meanwhile, during the continuing flight of "Soyuz-3" the astronaut noted the good maneuverability of the craft, its great dependability and high effectiveness of the automatic machines and manual control.

The astronaut carried out a considerable volume of scientific experiments and observations in accordance with the program. In particular, he conducted observations of the starry sky and earth, the luminous particles,

typhoons, cyclones and forest fires and carried out medico-biological investigations during the orbital flight. The day and dusk time horizons of the earth and the earth's surface were photographed from the craft. It must be pointed out that taking photographs of natural formations from the spacecraft has great interest for a wide group of sciences concerned with the earth, as well as for geobotanical, agrobiological and other research.

For example with the help of outer space photographs, the zones of snow beds can be traced, their dynamics can be studied and necessary data for making prognosis about high floods as well as important information evaluating reserves of moisture, can be discovered. Photographs of water basins, taken in different rays, expose the non-uniformity connected with the peculiarities of their flora and fauna.

Valuable information about geological structure, moisture, vegetative cover and erosion of land and about other peculiarities of the earth's surface can be had by analyzing the colored pictures of the earth's surface.

Data about the vegetational cover can be had and, apparently, in principle it is possible to solve the problem of crop evaluation.

Geophysical, geological, hydrogeological, glaciological, geobotanical, agricultural and other maps can be made more precise with the help of outer space photographs, particularly those territories of the globe which have been studied very little. Such information is very important for evaluating the natural resources of the earth.

It was envisaged in the experiment program that "Soyuz-3" would make 64 circuits. Before descent the astronaut oriented the craft in outer space by using manual control and then switched on the program of automatic descent.

The recovery capsule of "Soyuz-3" landed on October 30 at 1025 hours at a place 70 kilometers north of Karaganda city.

The duration of Beregovoi's flight was 94 hours 51 minutes.

The unmanned "Soyuz-2" and the manned "Soyuz-3" craft confirmed the correctness of technological decisions taken at the time of construction of the new type of manned craft with wide maneuvering capabilities. The rationale of the craft's design and the reliability of its systems on board was also demonstrated by the flight. Because of its maneuvering and mastery of the approach process it was possible to carry out still more complex experiments in the "Soyuz-4" and "Soyuz-5" spacecraft in the future.

Vladimir Aleksandrovich Shatalov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On January 14, 1969 the spacecraft "Soyuz-4" was put into orbit as an artificial satellite of the earth by using a mighty launch rocket.

The spacecraft was manned by pilot-astronaut Lieutenant Colonel Vladimir Aleksandrovich Shatalov, a citizen of the Soviet Union.

"Soyuz-4"

For successfully carrying out an outer space flight and ensuring the world's first transfer of astronauts from one spacecraft to another, accomplished during the orbital flights of the "Soyuz-4" and "Soyuz-5" craft and for displaying bravery and heroism, the title of the Hero of the Soviet Union with the award of the Order of Lenin and Gold Star Medal is conferred upon pilot-astronaut Vladimir Aleksandrovich Shatalov, commander of the "Soyuz-4" spacecraft.

* * *

For making an outer space flight in the "Soyuz-4" spacecraft, the title of the "Pilot-Astronaut of the USSR" is conferred upon Vladimir Aleksandrovich Shatalov, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

Vladimir Aleksandrovich Shatalov was born on December 8, 1927 in Petropavlovsk in the North Kazakhstan region. He spent his childhood in Leningrad.

Since his youth he had been attracted towards aviation. He graduated from an Air Force special school, an elementary school for pilots, and in 1945 he was enrolled as a pupil in the Kachinsk Air Force Pilot School.

After graduating from the school he worked as an instructor pilot. In 1953 he joined the Red Banner Air Force Academy, which he finished three years later.

After the Academy Vladimir Aleksandrovich served in Air Force units in staff positions.

He was accepted in the ranks of the Communist Party of the Soviet Union in 1953.

In January 1963 he was enlisted in the astronauts' detachment.

V.A. Shatalov is president of the Soviet-Cuban Friendship Society.

A DREAM COMES TRUE

VLADIMIR Shatalov was Georgii Beregovoi's flight-double. They had much in common: both were first class pilots, both had graduated from military academies. They both had the passionate desire to become testers of outer space technology and both of them fulfilled this desire.

And it just so happened that our first conversation with them both took place on the same day.

"I have been in the astronauts' detachment since January, 1963," Vladimir Aleksandrovich informed us. "During those days preparation for a new step in outer space was going on. Valerii Bykovskii, Valentina Tereshkova and their doubles were rehearsing the flight program. Then I felt for the first time the difference between the flight preparations of the air pilots and astronauts. The new work engrossed me completely, from the very first day. When I served in the Air Force, it seemed to me that the whole of my life was dedicated to it. I loved aeronautics. I liked it because during those years we continually received new, improved machines. Their speed, range and flying heights were unprecedented. It demanded a daily increase in our

knowledge. We fully realized the responsibilities of the Air Force to the country. We were proud that the motherland had entrusted us with the defence of our peace-loving people."

"But all the same—why the astronauts' detachment?" "Because I had an old dream—to become a test pilot. My comrades in the Academy, Valentin Mukhin and Evgenii Kukushev achieved their aim. I had to wait for a bit. By then Gagarin's flight had taken place followed by Titov's... Unprecedented technological advances also were made. I started thinking more about the outer space flights."

"Once you had been a teacher?"

"Yes, I still remember the work of Pilot-Instructor. I liked it. Probably this was inherited from my grandfather, who had been a teacher. The bringing up of pilots is a noble cause, but also a very responsible one. I myself learnt a lot during those years, and primarily how to judge a man's character. It is necessary to know fully both the strong and the weak points of a pupil, and help him develop the stronger ones so he can learn to fly excellently."

"As a rule, we ask the astronauts: who had the greatest influence on their lives..."

"In my life I tried to follow my parents, specially my father. All his life he was interested in technology and was extremely devoted to his profession of engineer-signaler. For my father and mother labor was always the main thing in life. I wished to become worthy of them."

Though Vladimir Shatalov did not tell us, by chance we came to know the very same day that his father, Aleksandr Borisovich was a Hero of Socialist Labor living in Leningrad. At the first opportunity we went to Leningrad. This was on the eve of the celebration of the 50th anniversary of the Soviet State, and during the time of launching the "Cosmos" craft for carrying out the experiment of automatic linkup in orbit.

* * *

An elderly woman opened the door.

"Aleksandr Borisovich? But he's only just left."

"But we have come to you too, Zoya Vladimiroyna."

"To see me?" She was surprised, "Well then, we are always happy when guests come. Please come in."

A small two-room flat. Very modest furniture.

"Please sit down."

"Have you been living in Leningrad for a long time?"

"Over forty years. I was born in the Ural Mountains, in Zlatoust. Then I went over to Kazakhstan along with my husband. We lived in Petropavlovsk in North Kazakhstan region, for a few years. Volodya was born there.

We brought him to Leningrad when he was two years old. Here he studied in the school. Now he is living in Moscow. He came to us for a few days in the summer. His life is restless."

At this time the door lock clicked, and a man of large build came into the room. He took off his greatcoat without hurrying and said hello to us. This was Aleksandr Borisovich. He asked what business had brought us to him.

"So, so. It means, you are writing an article about Leningrad. Well, that is possible, quite possible.

In his voice we could hear disbelief.

"I have already been on pension for fifteen years. You haven't come to the wrong place by any chance?"

"You are a communist, a Hero of Socialist Labor. It is interesting for the readers..."

"You must write about those who are working at present," Shatalov interrupted. "About the young ones."

"In that case let's talk about your son. We are acquainted with Vladimir Aleksandrovich. We met him in the 'Star City'. And your address was also given to us there."

The Shatalov couple knew their son was getting ready for the start. In their hearts they were waiting for this moment. Engrossing conversation ensued. Aleksandr Borisovich closely followed the outer space flights and the development of astronautics.

"To people with little knowledge, it seems that everything is simple, everything easy," said Aleksandr Borisovich. "I have seen a lot during my 78 years of life. I was a simple laborer, a mechanic in an aviation group, also a telegraphist and a typist. I could not finish the radio and communication faculty because of the war which started in the winter of 1939. Then there was the Nazi Hitlerite invasion of our motherland."

Our host was lost in thought, apparently recollecting the past.

"We are living in a stormy age. In front of my eyes the means of communication, and automatic machines have made such big advances, that it is difficult to believe at times. The railway engine driver maintains constant radio contact with the control points. Automatic remote control switches operate on the railway track. An auto driver guides the rolling stock. Man has created sensible instruments and utilizes them skillfully. How perfect must be the systems controlling the flight of a spacecraft, how much real talent is required for the creation of modern space technology! People will fly to the other planets and make use of their mineral wealth in the service of mankind."

"You consider this is possible?"

"Without doubt. I am saying this because transport technology and space technology in spite of their undoubted difference, have a lot of similarity in

principles. For example, in both fields an engine which has a definite power and is able to give the necessary velocity to the object, is needed. Both here and there, systems of controlling the movements are required. The linking up of the "Cosmos" satellites in near-earth outer space, the docking in orbit of "Soyuz-2" and "Soyuz-3" are enormous achievements. This remotely reminds one of the autocoupling of wagons. But on the earth, on the railway track it is one thing, and at a great height under conditions of vacuum and at speeds incomprehensible on earth quite another. Besides everything else, the craft must have the systems for searching one another and mechanical joining systems."

Like every engineer with wide practical experience, Aleksandr Borisovich thinks scientifically and at the same time concretely. We look at him, the veteran of four wars; the man who safeguarded the Soviet State, who defended it from the invasion of enemies, who built socialism. It is such men who have laid on earth the foundation of the launching pad of their sons' exploits in outer space.

"Do you know your son's friends?"

"We lived with Volodya in the 'Star City' for a few months. I liked Yurii Gagarin very much. And of course, all the astronauts are real people."

"Which aspects of the astronauts' character did you like most?"

"It is very difficult to say offhand. I did not actually work with them. A man is usually judged best at the time of collective labor. I am not saying anything new, but life has convinced me that labor is the greatest test of a man's qualities and defects. The feeling of responsibility is, perhaps, the astronauts' best trait."

"You recognize this trait in your son too?"

"Yes, he is disciplined, dedicated to his profession. Volodya grew up and took shape as every one else. And suddenly he appeared before me at the Front, and lived with me for a month and a half. We—I and my son—came to the conclusion that he would be more useful to the motherland if he were to get a specialization, maybe, in the Armed Forces. Volodya agreed. He completed eight years schooling at Petropavlovsk. At first he joined the elementary school for pilots, and in 1949 he graduated from the Kachinsk Air Force Pilot School."

"We wish to know as much as possible about how the future tester of space technology grew up."

"Volodya was always good at his studies. He was a diligent student," stated Zoya Vladimirovna.

"Persistent and stubborn," Aleksandr Borisovich added. "He graduated from the Military Academy with Honors. For seven years he served in fighter squadrons, was the deputy of an Air Force regiment commander, then pilot-instructor, and later he was enlisted in the astronauts' detachment.

Pilot-astronauts in Lenin's study
in the Kremlin.

"I did not know anything for a long time," smiled Zoya Vladimirovna. "Later, when I went to the 'Star City' to visit my son along with Aleksandr Borisovich, I saw Gagarin, Titov, Nikolaev, Popovich...and understood everything."

"Brave people," said Aleksandr Borisovich. "I told you, their main quality is the sense of responsibility. Well, that's to say too little for their full description. Everyone of them is a man of great courage and a patriot of the motherland. A wonderful generation! From the fullness of my years I can well see how much our nation and our party has achieved during half a century. My father could never dream that his son would receive the highest labor distinction, the title of the Hero of Labor from the State, and that his grandson could receive the best military education."

"I have lived a happy life," said Aleksandr Borisovich in conclusion. "And I am proud that my son has been still more fortunate..."

Vladimir Shatalov is carrying out a responsible task. His craft "Soyuz-4" must approach and link up with the "Soyuz-5" craft, with its crew

commander Boris Volynov, Engineer-Investigator Aleksei Eliseev and Flight Engineer Evgenii Khrunov. After linkup the members of the crew of "Soyuz-5" must go over and board Shatalov's craft.

The creation of the world's first experimental outer space station is an outstanding step on the path to permanently working scientific orbital stations with changing crews. The future belongs to them.

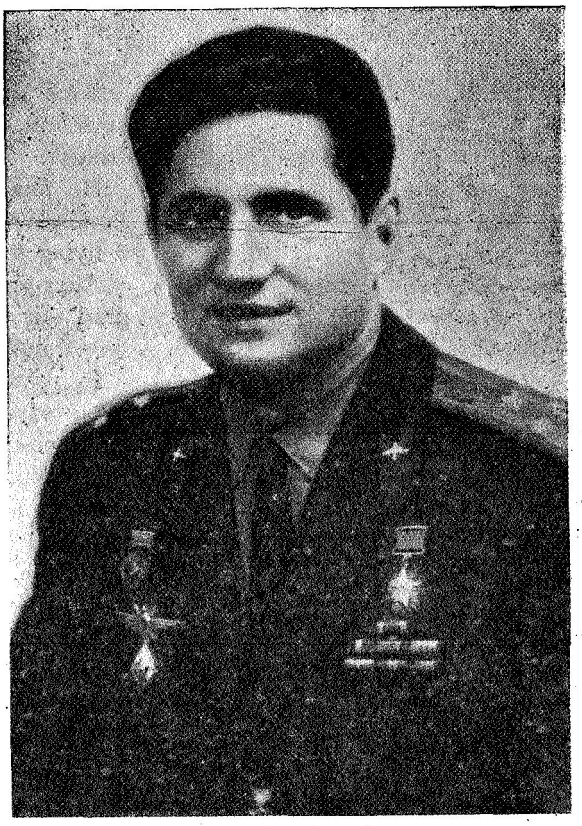
People who saw on television how the linkup was carried out thought that everything took place very smoothly, very simply.

When Vladimir Shatalov returned to earth, he was asked the question: from where does this apparent simplicity come? The astronaut replied:

"Tens of thousands of people created these complex, intelligent and obedient machines. And when you feel that the machine is under your command, the feeling of confidence comes by itself. It is satisfying that such excellent technology is put at the astronauts' service. We have done everything on the land to learn how to control it skillfully."

"How difficult is it to control apparatus in the linked-up situation?"

"There were no difficulties. My main work in outer space was to carry out the linking up of two craft with the utilization of automatic machines and manual control. The processes of linkup and delinking were carried out successfully."



Boris Valentinovich Volynov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On January 15, 1969 the spacecraft "Soyuz-5" with a crew of three astronauts was put into orbit as a satellite of the earth.

On board the spacecraft were Soviet Pilot-Astronauts: craft commander Lieutenant Colonel Boris Valentinovich Volynov and crew members—Flight Engineer Aleksei Stanislavovich Eliseev, Kandidat of Technological Sciences and Engineer-Investigator Lieutenant Colonel Evgenii Vasil'evich Khrunov.

"Soyuz-5"

For successfully carrying out an outer space flight and ensuring the world's first transfer of astronauts from one spacecraft to the other, accomplished during the orbital flights of the "Soyuz-4" and "Soyuz-5" spacecraft, and for displaying bravery and heroism, the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Boris Valentinovich Volynov, commander of the "Soyuz-5" craft.

* * *

For making an outer space flight in the "Soyuz-5" spacecraft, the title of the "Pilot-Astronaut of the USSR" is conferred upon Boris Valentinovich Volynov, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

Boris Valentinovich Volynov was born on December 18, 1934 in Irkutsk.

He finished secondary school in Prokop'evsk and then studied in a flying school.

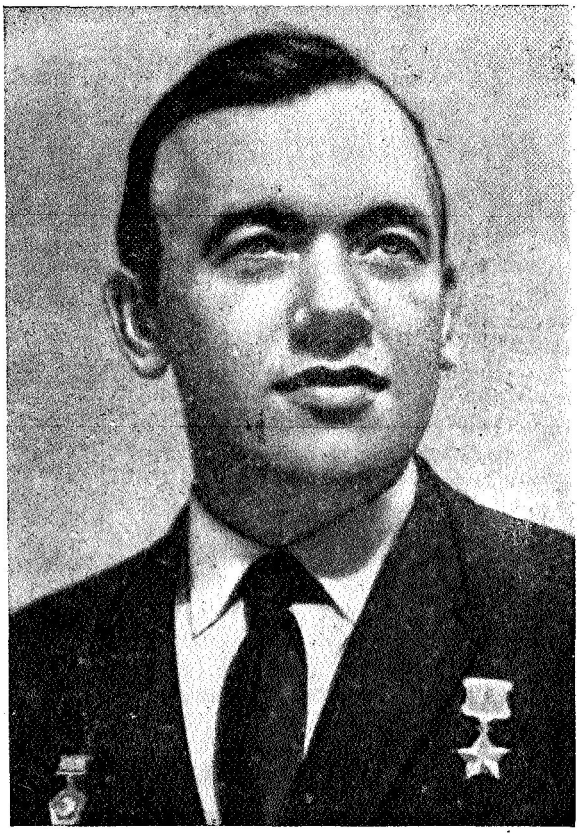
After graduating from the Volgograd Air Force Flying College he served in Air Force units since 1956.

In 1958 he was admitted to the ranks of the Communist Party of the Soviet Union.

He joined the astronauts' detachment in 1960. Volynov was double for Valerii Bykovskii and Georgii Beregovoi.

While continuing his main work Volynov also graduated from the N.E. Zhukovskii Air Force Engineering Academy in 1968.

1961—1971



Aleksei Stanislavovich Eliseev,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On January 16 at 1120 hours Moscow Time, the manual linkup of the spacecraft "Soyuz-4" and "Soyuz-5" was successfully accomplished... The world's first experimental outer space station was assembled and started functioning in orbit as an artificial earth satellite.

"Soyuz-5"

For successfully completing an outer space flight and ensuring the world's first transfer from one spacecraft to the other, during the orbital flights of the "Soyuz-4" and "Soyuz-5" spacecraft and for displaying bravery and heroism in this, the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Aleksei Stanislavovich Eliseev.

* * *

For making an outer space flight in the "Soyuz-4" and "Soyuz-5" craft, the title of the "Pilot-Astronaut of the USSR" is conferred upon Aleksei Stanislavovich Eliseev, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

Aleksei Stanislavovich Eliseev was born on July 13, 1934 in Zhizdra City of Kaluga region. He spent his childhood in Moscow.

After finishing secondary school he joined the Bauman Higher Technical School, Moscow, in 1951.

While working in a designs bureau in 1967 A.S. Eliseev defended his thesis and got the degree of Kandidat of Technological Sciences.

He started training in the astronauts' detachment in 1966.

In 1967, he was admitted to the ranks of the Communist Party of the Soviet Union.

1961—1972

Evgenii Vasil'evich Khrunov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On January 16, 1969 during the 35th circuit two crew members of the "Soyuz-5" spacecraft—pilot-astronauts E.V. Khrunov and A.S. Eliseev—got into their spacesuits and made an exit into open outer space through the hatch of the orbital compartment. After carrying out a number of scientific experiments and observations in open space A.S. Eliseev and E.V. Khrunov went over to the orbital compartment of the other spacecraft, "Soyuz-4"... The transfer of two astronauts from one craft to the other during orbit as an artificial earth satellite has been accomplished for the first time in the world.

"Soyuz-5"

For successfully carrying out an outer space flight and ensuring the success of the world's first transfer from one spacecraft to the other, during the orbital flights of "Soyuz-4" and "Soyuz-5" and for displaying bravery and heroism, the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Evgenii Vasil'evich Khrunov.

* * *

For making an outer space flight in the "Soyuz-4" and "Soyuz-5", spacecraft the title of the "Pilot-Astronaut of the USSR" is conferred upon Evegenii Vasil'evich Khrunov, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

Evgenii Vasil'evich Khrunov was born on September 10, 1933 in the village of Prudy in the Volovskii district, of Tula region.

He finished seven year secondary school and the Agricultural Polytechnic; after that he passed from the Air Force School and Flying College and served in Air Force units.

In 1959 he joined the ranks of the Communist Party of the Soviet Union.

He was enrolled in the astronauts' detachment in 1960 and became Aleksei Leonov's double

In 1968 E.V. Khrunov graduated with honors from the N.E. Zhukovskii Air Force Engineering Academy.

'ZARYA', THIS IS 'BAIKAL'

We were all waiting for this moment! And now it had come. Two spacecraft, "Soyuz-4" and "Soyuz-5" approached one another and linked up. This moment could be viewed because of Spacevision. Millions of people became eye witnesses of this striking new victory of Soviet science in outer space.

...The familiar noise could be heard on the T.V. receiver. And now the pictures also appeared: a direct telecast from outer space was taking place. By the remarks exchanged between ground control and the astronauts, it was possible to visualize how the manual linkup was being accomplished. "Amur" was the call sign of the commander of "Soyuz-4" and "Baikal" of the commander of "Soyuz-5". "Zarya" was the earth's call sign.

Shatalov: "Everything normal. All well. Distance—40 meters, speed—almost zero. We have started the approach."

Earth: "Message received, we are observing you."

Volynov: "Roger, 'Amur', Message understood..." " 'Zarya', 'Zarya' this is 'Baikal', receiving you clearly. Distance—40. Craft under perfect control..."

Shatalov: "Request permission to carry out docking."

Earth: "Permission granted... This is 'Zarya'. Please report briefly as soon as possible."

Shatalov quickly replies, saying he can see "Soyuz-5" excellently on his screen.

On the television screen the picture of "Soyuz-5" becomes bigger. The craft are approaching one another: an unforgettable, thrilling spectacle! The voices of the craft commanders come to us from outer space.

Volynov: "All well. Everything working perfectly. Waiting for the contact."

Shatalov: "Coming near. Everything normal. Hold it. Contact! linkup."

Earth: "Seeing you clearly. Every detail understood. Everything fine: straight into the 'socket'."

The craft straighten. At this time one of the astronauts cracks a joke: "The handshake has begun". The handshake of spacecraft. How vividly had the astronaut characterized the event.

Volynov: "Welcome!"

Shatalov: "Welcome! 'Baikal'."

Boris Volynov replied that he had been searching for a long time and had only found him now.

The sense of humor and joviality, characteristic features of both commanders was not lacking even so far from the earth.

Shatalov and Volynov exchange their impressions and described what they saw.

Volynov: "We can see even the markings. Vision is beautiful. Just now the picture is very sharp. Very good."

Shatalov: "Here also it is wonderful. Even the television indices can be seen well. The screen is also visible. Something is gleaming nearby."

Volynov: "I am receiving you well 'Amur'."

Earth: "The craft are straight. No heel is visible. We can hear you and see you. Everyone here congratulates you on your success."

Shatalov: "Roger. The linkup went excellently. The craft have been straightened. Tightening continues..."

"Zarya" once again warmly congratulates the astronauts, and then suggests that they should continue their work.

It was possible to witness another remarkable experiment thanks to video recording. The report was relayed from "Soyuz-5". Two astronauts were getting ready to go out of the craft.

Earth: "We are observing you."

Shatalov: "The craft is now in a stabilized position. The station is conveniently oriented for the men going out..."

On the television screen it can be seen how Aleksei Eliseev goes over from one craft to the other in outer space. Evgenii Khrunov had already entered

the orbital compartment of "Soyuz-4".

The next stage of the flight started. The exterior cameras of "Soyuz-4" were switched on. Vladimir Shatalov started the delinking of the craft. We could see how the craft parted. We felt as if we were at that moment in the cabin together with Shatalov, Eliseev and Khrunov and following with our eyes "Soyuz-5", which was now moving away. The flight of the world's first space station, assembled in outer space, had been successful. On the screen was Volynov's craft, moving off. It was illuminated by the sun. The twinkling light beacons, the docking units and antennas could be seen.

"Soft landing! Till we meet on earth!" Boris wished his friends.

After some time the crew of "Soyuz-4" completed the flight, but the cheerful voice of Volynov continued echoing from outer space:

"Everything is in order on my desk. I am feeling fine. I am carrying out various scientific-technological experiments. I am seeing amazing pictures, the like of which I never saw on earth. The halo near the horizon is very beautiful, particularly the dawn and evening-glow. It is difficult to describe all its colors..."

How many times Boris had dreamed of this moment and how persistently had he worked to earn the right to fly into the starry depths.

Volynov was one of the veterans of the Soviet astronaut's detachment.

Veteran! This word tells us that Volynov was by the side of Gagarin, Titov, Nikolaev, Popovich, Bykovskii, Tereshkova, Komarov, Feoktistov, Egorov, Belyaev, Leonov and Beregovoi at the time of all their flight preparations. Our first meeting with the future astronaut took place in August 1961 before the launching of "Vostok-2". Volynov was seeing off Titov.

Boris was considered to be in the "second line" of future spacecraft commanders, therefore at that time we could neither talk to him about his life nor get any official biographical information about him. We had to hear and observe for ourselves and take down everything said about Volynov by the astronauts, specialists and all those who knew the pilot well.

He was born in Irkutsk, but his childhood and youth was passed in Kuzbass, in the miner's city, Prokop'evsk. Boris grew up at a difficult time. The war with the Nazis was going on. Boris's mother, Evgenia Izrailevna, a doctor by profession, devoted all her time and strength to her work. His step-father Ivan Dmitrievich was fighting in the army.

But the Front was not restricted to the battle line only. The miners formed "front line brigades", which did not come up to the surface for days on end.

The Prokop'evsk miners had rich revolutionary labor traditions. During the years of civil war, the inhabitants of Prokop'evsk constructed a branch line of the Trans-Siberian railway line. Lenin came to know of the heroic construction. In 1920, wagons of coal were sent to Moscow and a delegation of Prokop'evsk miners visited Lenin. In reply to the leader's instructions to

dig more coal for the country, the miners took an oath on behalf of their comrades—that there would be as much coal as was required.

Many people of the same age as Boris wanted to become miners like their fathers and grandfathers. Boris loved and respected the miners, but he had his own cherished dream.

Chkalov and Serov were the boy's childhood heroes. He read and re-read everything written about the exploits of the pilots who fought the Nazis.

The dream to become a pilot came true. After getting secondary education, Volynov finished aviation school and, in 1956, the Volgograd Air Force Flying College. He served as a pilot, and then came over to the astronauts' detachment.

He did not break his connections with Prokop'evsk—for his mother was still living there. He maintained his friendly relations with his schoolmates, specially with Evgenii Luk'yanov. Evgenii has preserved whole packets of letters written on exercise book pages.

"...We were at the bluest sea—the Black Sea, wanted to go to Prokop'evsk after the sanatorium, but had to go back to the unit. Advice was given to stay nearby..."

"...I am studying at the Zhukovskii Academy, I am learning sense. I am, in fact, an 'abnormal' pupil. At present, when all the students are resting, we are taking examinations of the third semester. We thought that we had worked and could now go on leave, but instead we have to take examinations. Have already taken two; three are to come. I am laboring by the sweat of my brow."

"...Everything is the same. It is rather tough to study and work, specially at such a job as ours..."

"...You may congratulate Tolya Portnikov. He is now a Kandidat of Sciences. It's true that I myself was not present at the ceremony. I was busy with my own affairs. I have to content myself with congratulating the newly born 'out of date scientific dry old stick'..."

"...How do you do Zhenya! Excuse me for calling you 'boss', like this. Congratulate you on your 'dizzy career'. Wish you health and another three steps up the ladder in another year or two. This is not bad, it means the head is cooking things up... About myself, I may boast a wee bit—now I am a Major..."

"...Write. Don't be snooty, O.K.? When can you manage to come over to see me? I so wish to talk things over like the old days, like in school..."

The letters were written during Boris Volynov's intensive training for the flight. He didn't know exactly when the flight would take place, but was confident that he would definitely fly.

At the cosmodrome, before the start, Valerii Bykovskii described how he underwent his training, how first of all he went into the mysterious sound-proof chamber.

"Boris was the second person from the first group of astronauts to join", said Valerii and looked at his double with pride.

Although the main "object" of the conversation was Bykovskii, we also wanted to know the double's opinion about the various problems of astronautics and about the training of astronauts. But Boris shook us off with his silence. Suddenly, however, a question about bravery interested him, or rather, stirred him.

"Bravery is not simply fearlessness", observed Volynov. "Not to lose one's head, not to be frightened on meeting a strong adversary is bravery. But what words can determine the degree of a man's bravery, who consciously goes out to confront a stronger adversary? Think of the fears of my fellow countryman Aleksandr Pokryshkin from Siberia. A number of times he deliberately started dog fights with enemy aircraft although heavily outnumbered."

"Bravery is willpower," added Varerii, "self control under difficult circumstances. Bravery is intelligent pluck."

"Intelligent pluck. Valerii, your observation is very apt. I would add further: pluck is a man's capacity to take the right decision in difficult situations. And for this, exact technological knowledge is required. Without this, pluck or heroism is fruitless. We are not living in a century when the inhabitants of Siberia went to hunt a bear with just a spear. Though even then they had their own knowledge."

"And what, according to you, is the source of human bravery?"

"High aims," said Bykovskii.

"Yes, a high goal," affirmed Boris.

The days went by. The pages of notes bearing Volynov's surname grew. We complained to Tershkova that this affair was moving very slowly. She started laughing and said:

"Take down: handsome, tall, with clear eyes. His main quality is to do everything calmly, clearsightedly. Boris has learnt well the truth, that nothing is mastered easily in life."

Yurii Gagarin expanded this characteristic:

"Speaking about Boris, I can say that he has all that a man needs in persistence, stubbornness and cool temperament. It is difficult to talk about one's friend, one is apt to praise excessively. Many warm, hearty words can be said about Boris—his wonderful physical preparation, self control, seriousness, deep knowledge, etc. are his distinguishing marks. He can definitely be made a commander of a craft."

Boris had prepared himself for a prolonged flight program. The pilot's organism had got accustomed to great loads and, I would say, even to high gravity pressure. His persistent training paid off.

Boris, like the other members of the crew, went to the cosmodrome, and saw the launching of spacecraft. He could clearly foresee how his own craft

Preflight working days of Boris Volynov.

would get underway.

And now some more notes, from Baikonur. The State Commission has approved of the crew of "Voskhod" consisting of Komarov, Feoktistov and Egorov. After conversing with them, the journalists passed by a tennis court. Here a tense struggle was going on between Volynov and General Kamanin. Watching the game, Andriyan Nikoalev observed:

"Boris is cooling down."

"What happened?"

"Only yesterday the preliminary decision about the crew was taken. Of course, he had dreamed of flying. The preparation for the start is made in such a way that till the last moment nobody knows whom luck will favor."

"But can't the information be given earlier, so that the pilots don't feel so nervous."

"No," answered Andriyan's doctor, Evgenii Anatol'evich.

"There is an important psychological consideration. It seems to us that when a man knows he is only the double, inadvertently he may weaken his attention and somewhere or the other allow oneself a respite, thus lowering his preparedness."

"Constant preparedness and competition—these are the most valuable things. They help in perfecting the level of a man's readiness from the point of view of space travel technology, as well as from the purely medical point of view. But before everything else they prepare him from the psychological point of view."

"Do not distract Boris from his game." Nikolaev said earnestly. "Sport is the best medicine just now."

One more meeting with Volynov when he was already appointed commander of "Soyuz-5". We started discussing his heroes in life.

"Who do you remember with special gratitude?"

Volynov named his friend Zhenya's father, Pavel Fedorovich Luk'yanov, who covered the path from an uneducated laborer to professor; and the pilots Shilov, Es'kov, Zubarev, Ivanov, Reshetov, who gave him his start into jet aviation.

"There is one more person, whom I deeply respect. This is Academician Sergei Pavlovich Korolev. He is the creater of our space-rocket systems. But, maybe the chief designer's greatest service is the fact that he was able to rally the most eminent scientists around the idea of space conquest, and personally brought up a big group of young designers and engineers. He inspired us with his own dedication to this business, and with such devotion everything is possible.

ALEKSEI ELISEEV'S MAIDEN TRIP

THERE is a museum in the Moscow Bauman Higher Technical School. It exhibits the history of the country's oldest technical institute of higher learning and its alumni. On one of the stands there are materials and documents concerning the student life and activities of Academician S.P. Korolev, and then as a teacher of the school. Also on display are portraits of pupils and followers of the Academician—astronauts K.P. Feoktistov, Doctor of Technological Sciences, and A.S. Eliseev, Kandidat of Technological Sciences.

...Under glass there is the examination admission card No. 964. On it is a stamped photograph of a blond boy in a white shirt. The stamp attests that this is Aleksei Stanislavovich Eliseev. The date is June 11, 1951. Under it, an illegible signature of the executive secretary of the admission committee.

After passing the strict examination and having collected the necessary percentage of marks, Eliseev became a student of MHTS. Entry into the school was very competitive. During that year only one in ten of the applicants got admission.

The future scientist was finally moulded as a citizen and specialist within

the walls of MHTS. To the wonderful collective of teachers, who passed on their learning to the students and tested the capabilities and talents of each, must be credited this successful moulding process.

Aleksei Eliseev studied with perseverance and at the same time with ease. Even now he recollects the lectures and experiments in the laboratory with pleasure. The future engineer had enough time both to solve difficult integral equations and to fence; to trace sketches and to carry on sword play. It was not surprising that together with distinction marks for academic subjects, Aleksei Eliseev received the title of Master of Sports of the USSR. Love for the fine arts and literature was another of Eliseev's interests. He speaks about authors, artists and their creative work with as much enthusiasm as about his own beloved profession. Perhaps Vladimir Mayakovskii's poetry fascinated Aleksei more than anything else during his youth. The poet helped him to understand the world better, to feel "in the continuous fever of everybody work."

The young man loved Mayakovskii for the fact that he had written the same sentiments as Aleksei in an essay at the time of entrance examination to a higher institution of learning. "I dedicated all my powers, all of my mighty talent to the service of the motherland and its people."

Aleksei Eliseev loved people with high civic ideals. He considered S.P. Korolev to be such a person. For the young engineer, Sergei Pavlovich became the model of the man who could work dedicating the whole of himself to his profession, who combined intellect with the talent of organizing the efforts of several people towards the single goal of solving the problems of space conquest.

"I met Sergei Pavlovich a number of times," recollects the engineer. "I requested him to enroll me in the group of specialist-testers of outer space technology. He listened to me attentively till the end, and always answered briefly: 'I am confident that you will be needed,'—and after a pause he added cunningly, in typical Korolev manner 'you will definitely be needed . . . but not today'. "

"But all the same, what led you to become a space technology tester?"

"The knowledge I received in the technical institute, my profession of engineer of automatic mechanisms and probably my passion for the theory of automatic control. This science has become an integral part of almost all branches of technology and industrial production. The basic laws of automatic control are one and the same; only the technique, created on their basis, changes.

"But what called you into the technical institution?"

"Into the school? I wanted to become an engineer. I loved mathematics and physics since childhood. I mastered the exact sciences without any effort."

"And chemistry specially?"

Aleksei Stanislavovich smiled:

"Of course. In a family, where the mother is a chemist, it is natural that this science has the highest recognition, though I was neutral towards it. My mother is a person of wide viewpoint." Keeping quiet for a second, he added, "A person of rare purposefulness and diligence, she steadfastly overcame the many difficulties and adversities, in her life. Interested in chemistry my mother dedicated her whole life to it. Now she is a Doctor of Science. And my passion for technology was encouraged by her in every possible way and I did not enter MHTS without her advice."

* * *

...One more document ... The examination mark-sheet. "Fundamentals of planning"—"Good". "Industrial practice"—"Excellent". "Defence of diploma work"—"Excellent". Hence the school administration observation in the testimonial sent to the commission for allotment of work to the young specialist: "During the period of study A. Eliseev was found to be excellent progress, who combined skillfully his studies with a lot of social work and sport. He has a knack for distributing his time properly and planning his work well; he is persistent in his efforts."

After completing MHTS, Aleksei Eliseev, who had been attracted by the ideas of space conquest in his student days, found the work he aspired to. The talent of the engineer came to light, in the collective engaged in the creation of outer spaee technology. He was entrusted with more and more responsible problems which required not only knowledge but also genuine creative work. It was here the engineer defended his thesis and passed the Kandidat of Sciences degree.

... Those who assault outer space have much in common in their lives. Just consider: almost everyone of them had experienced, to different degrees, the burden of war, became self dependent and at times were even helping their parents, by the time they were fifteen years old. All worked hard at their jobs, which demanded knowledge and a liking for their professions: pilot, engineer, doctor... All the future astronauts had to strive to participate in space conquest. All had firmly decided to become astronauts. Aleksei Eliseev was no exception...

On January 15, Fight Engineer Aleksei Eliseev and Engineer-Investigator Evgenii Khrunov went up into outer space in the "Soyuz-5" craft, flown by pilot astronaut Boris Volynov. The "Soyuz-4" with pilot-astronaut Vladimir Shatalov on board, waited for them in orbit as an earth-satellite to carry out joint experiments. They were to set up the world's first experimental orbital station. After linking up the craft in outer space they had to carry out the transfer of members of the crew of one craft to the other via open outer space, and during this time undertake a number of assembly

Honorary citizens of Kaluga.

and dismantling jobs. But before undertaking the linkup of the craft they had to thoroughly test the workability of all the systems, first of all of those helping in the approach and docking, as well as those delinking the craft. This was the responsibility of Flight Engineer Aleksei Eliseev, a representative of yet another outer space profession.

The craft are linked up. Putting on their spacesuits, Evgenii Khrunov and Aleksei Eliseev go from "Soyuz-5" to "Soyuz-4". Nothing of this type of transfer had ever been done before. And the world, holding its breath, watched how Eliseev "walked" slowly but confidently in Khrunov's footsteps. And the craft were flying at about the speed of about 28 thousand kilometers per hour.

The setting up of an orbital station was a main trend in the development of Soviet astronautics.

"Aleksei Stanislavovich, if you became the scientific guide of the station, representatives of which professions would you take along with you?" we asked the astronaut once.

"That for me will never arise," he smiled. "But seriously speaking, in my view, specialists of various types will be needed on board. First of all the presence of service personnel is essential. Their duty is to ensure the normal 'working life' of the innumerable systems. Doctors and biologists, working out the means of raising man's stability under conditions of outer space flight are necessary. I think astronomers, geophysicists, oceanologists, meteorologists and representatives of other branches of knowledge can also not be left out. Well the station is a scientific one! It is, so to say, an outer space research institute, and if you like, one of even broader scope."

"Eliseev is made in such a way that even when looking at the distant future, he approaches from a practical viewpoint."

"And what can the discoveries made in the space station give the people?"

Aleksei Stanislavovich gave this answer:

"The scientists working on the station will get new or more accurate data about the universe and about the earth as well. There is no doubt that these investigations will have an ever increasing economic importance. For example, the specialists can keep a track of the distribution of precipitation on the planet, and forecast its distribution; this means they could also work out recommendations for practical workers. From outer space the scientists can send signals about the appearance of the centers of forest fires, the beginning of sand storms and typhoons."

"The prospecting for minerals from the near-earth outer space has enormous practical importance. At present a method is being worked out so that it might be possible to draw geological maps with the help of pictures relayed from the spacecraft or outer space stations." "With the help of pictures taken from outer space it will be possible to draw geological maps of almost the whole world. People will know where to search for the needed minerals. Once I had a talk with geologists. They await a lot from man's penetration into outer space. The geologists are already at present satisfied with our work discovering the hidden treasures of the earth. One of our leading geologists said that the photographs of the Soviet territory taken by Georgii Beregovoi saved considerable resources of the country. Of course, the main task at present is a thorough study of the earth and near-earth outer space."

"But will not a prolonged stay for scientists in outer space have harmful effects on their organism?"

"It would be better to address this question to the representatives of space medicine. One thing is clear—during every flight only harmless activities will be allowed. I think in future a combination of several means: some artificial pressure, special physical exercises and possibly medicines will be essential for safeguarding man in outer space."

"Perhaps, the change of crew in the orbital stations will present great difficulty? Besides the inhabitants of the station should be supplied with all the necessities for living and working."

"According to me, spacecraft similar to the 'Soyuz' will regularly fly on the route 'earth-orbital station-earth'. Naturally, they will have systems providing for approach, docking and linkup, good payload...I believe that the space stations have a great future, and I am ready to go into outer space any number of times for their establishment."

AN ASTRONAUT RECRUITED ALONG WITH GAGARIN

Among his friends he is famous as a passionate lover of books. When he is engrossed in a book, he neither sees nor hears anything around him. No, he is not an astronaut, but a Soviet film director, Aleksandr Dovzhenko.

It would seem that the creative work of the film director is very different from Evgenii Khrunov's work. But suddenly a very interesting discovery is made. It happened that speaking at the Second All Union Writer's Congress, Aleksandr Dovzhenko had expressed the idea of flights into outer space.

"Here, listen", says Evgenii and read out for us:

"I do not call on anyone to take up tearful, pessimistic subjects. Like you all I also love the nation. I understand that my personal life has sense only so long as it is dedicated to the service of the people. But if during the first flight to Mars my dearest brother or son were to die somewhere in outer space, I would never say that I am getting over his loss. I shall say that I am suffering, and I shall weep in my garden during the nights, muffling the sobs with my cap so as not to frighten the nightingale on the blossoming cherry tree, under which the lovers are kissing."

The astronaut continued:

"And, you see, Dovzhenko said all this in the year 1954, three years before the launching of the first artificial earth satellite and seven years before Yurii Gagarin's feat. Two years later Aleksandr Petrovich again returned to the topic agitating his mind. In his note pad were the words: for the script of 'Flight into outer space.' This is what Devzhenko had written: 'One of the three passengers of the interplanetary craft does not believe in the existence of life on other planets. The development of this topical theme presents enormous possibilities for drama. This non-believer was the person who died, while the believers were victorious.' In the file is a description of the future scenario 'In the vasts of outer space.' Dovzhenko drew the first rough outlines, put down scattered ideas, everything in fact that could be useful in his work."

Evgenii Khrunov closed the book and smiled:

"Of course, the flight into outer space looked different from what was imagined by Aleksandr Devzhenko. Everything is built on a strictly scientific basis. Every crew is selected very thoroughly and undergoes lots of training. In it there are only believers: believers in the wonderful Soviet rockets and crafts; in the strength of the intellect of our scientists, designers; in the mastery of engineers and workers, in their own knowledge and skill. It is a pity that Aleksandr Petrovich did not remain alive till the space era."

But he, Evgenii Khrunov, was lucky enough to go into outer space, to repeat the exit into open space. He carried out assembly and dismantling works, scientific observations and took movie shots in space together with Aleksei Eliseev.

The astronaut recruited along with Gagarin waited a long time for his turn. He did not simply wait, but, as they say in the detachment, studied intensively and prepared himself.

One story is often told. A comrade fighter-pilot came to Khrunov and got interested in his personal library. He saw books on astronomy, rocket construction, physics, mathematics, instrument designing, electronics and other technical subjects. And just by their side there were volumes on the fine arts, education, collections of poetry...and political literature. The astonished pilot asked Evgenii why he needed these books, since they were in no way connected with his profession.

"All this has a connection with the human being," observed Evgenii Vasil'evich. "For an astronaut it is important to be knowledgeable in the most varied spheres..."

Aleksei Leonov, whose double Khrunov was, said that both of them had many difficulties during the training. They worked for hours in spacesuits. There Evgenii's urge to know everything in detail came to the surface several times.

"He always tried to achieve first place with persevering labor. But he did

not thrust himself forward. He was guided by the desire for self perfection."

The experiment with exit into open space was under preparation. For training the selected pilots, special trainers were designed.

Besides the usual training the astronauts prepared themselves to work in a deep vacuum and in free outer space. But how to work out the control of the airlocking and lifesaving systems? The exit from the craft into outer space and the return were rehearsed in a special simulator. People responsible for the experiment carefully thought over the problem how the commander should act if something happened to his comrade in free outer space. Quick and reliable help was planned.

Leonov and Khrunov had not only to be able to orient themselves at the time of exit from "Voskhod", but also to coordinate very accurately their movements in outer space where there is no support. The movements were worked out in a simulated model of the spacecraft placed in an aircraft laboratory having a fullscale airlock chamber.

The problem of working out the exit into open space and return to the craft was placed before the astronauts. All this was done in stages. First of all Leonov and Khrunov put on the haversacks of the automatic lifesaving system. Then the equipment which ensured exit was checked, pressure in the airlock chamber and the cabin was equalized. After reaching the airlock chamber the astronauts checked the airtightness of the spacesuits and the supply of oxygen.

The commander of the craft closed the entrance into the airlock, imitated the reduction in pressure in it and opened the lid of the exit hatch. The astronauts went away from and came up to the airlock, and then returned into the cabin. It would seem that everything was simple. But in fact how difficult it was for Leonov and Khrunov! It was never possible to achieve smooth exit and approach to the model of the craft. This is where their sweat poured out in streams! The exercises were repeated times without number, until the desired result was achieved.

When Leonov finally emerged into actual open space, Khrunov literally glued his eyes on to the television screen. He was extremely agitated! And then blurted out shortly:

"Everything is normal."

People used to say earlier: "Levsha the skilled cobbler from Tula could make shoes for a flea." Now we can say: "A boy from Tula worked in outer space." Evgenii Khrunov was from Tula. Whatever the path his life followed, he never forgot his native village, Prudy, the "Lenin Memorial collective farm", the Ivan'kov Agricultural Polytechnic, his childhood and youth days. No matter how far in time they may be, these memories are felt very sharply.

Zhenya loved to go on the tractor with his father, and spend much time over the engine. He wanted to know and be able to do everything. He went to

school when he was six. He just sat behind the desk against the rules since he could not be enrolled. He was not of age."

In the fall of 1941, Zhenya was to become a fullfledged school student, but the war started in June. The enemy arrived in September...and in December the cavalry units of General Belov beat back the Nazi occupation forces and drove them west.

Zhenya went to school. The family was a big one: father, mother and eight children—six sons and two daughters. The postwar years did not ease the situation. Though the children often did not get enough to eat, yet they studied with interest and helped their parents in everything. When Zhenya was studying in the seventh class his father died. The boy decided to join the polytechnic where he would get a scholarship, albeit a small one. All the same it was a help for the mother and the tiny tots.

Somehow unexpectedly the dream to fly grew. It led Evgenii first to an Air Force School, then to college, and finally to service in Air Force units, where he could perfect his technique and achieve great speeds and heights.

The young officer was very happy when he saw the legendary Soviet ace Dmitrii Glinka, twice Hero of the Soviet Union among the commanders. In the college itself Instructor-Pilot Vasilii Basakov spoke a lot about the wonderful pilots Pokryshkin, Kozhedub, Lavrinenkov, and the Glinka brothers, Boris and Dmitrii.

Khrunov knew well the life of the Hero, who had fought in the Crimea, Southern, Northern Caucasus, and First and Third Ukrainian Fronts. During the war years Dmitrii Glinka flew about 300 sorties and personally shot down 50 Nazi aircraft. He wanted very much to be like the Hero. Evgenii remembered Glinka's words:

"A weak pilot twists around in his seat like a weather-cock, tensely keeping track of the instruments, and the horizon. He lacks the lightness in flight, lacks that blending, when pilot and machine constitute one whole. This is the secret of an ace pilot."

And Evgneii Khrunov made efforts to achieve this. He loved to fly to the point of self-oblivion. He became one of the best fighter pilots.

The inhabitants of Tula are proud of their fellow-townsman. The workers of the "Lenin Memorial" agricultural artel elected him as honorary collective farm worker.

The news of Khrunov's flight met with an enthusiastic triumphant reception in the polytechnic. A "lightning" information bulletin appeared in the academic section. It stated that an ex-pupil of the polytechnic, Engineer-Investigator Lieutenant Colonel Evgenii Khrunov was at present a member of the "Soyuz-5" spacecraft crew.

"We are delighted at the new remarkable victory of Soviet science and technology in the conquest of the starry distances," A.I. Navol'nev, the head

of the academic section announced. "It is especially pleasing that a native of our Tula region, who had studied in this polytechnic, is among the conquerors of outer space."

"I remember Zhenya very well," his teacher B.V. Shago said. "He was an active, ingenuous and inquisitive lad. He studied perseveringly. This is proved by the high marks entered in his personal papers, which have been preserved in the polytechnic. He loved to tinker with agricultural machinery and said that in this way he could better absorb the material he had studied. Zhenya also took an active part in social life."

Evgenii Khrunov was the second Soviet astronaut to go out into open space. This he did on January 15, 1969—almost four years after Aleksei Leonov's exit. On his return to the earth he described his impressions:

"I stood, if I may use the word, near the exit hatch of the orbital compartment of 'Soyuz-5' in a condition of weightlessness. When the hatch opened, the first thing I saw was the earth, and the black sky against the horizon. At that moment it seemed as if I was standing before the open door of an aircraft and must jump out soon. The earth was not so far off. These emotions disappeared after I started the transfer program. Then all my thoughts were concentrated on accurately and punctually going over to the other craft."

"Two linked-up craft present an astonishing and impressive sight. It is a big orbital station. I examined the craft from outside and did not find any deviations from the norms."

"Then I started the change over. I waited till Aleksei Eliseev came out of the hatch up to his waist, so that we have the so-called visual contact and not just a radio one. I carried out a number of experiments at the time of the change over. Then I 'entered' the orbital compartment of 'Soyuz-4'. The first impression was as if I had entered another house. Jokingly, we begged forgiveness of Volodya Shatalov for keeping him waiting twenty-four hours."

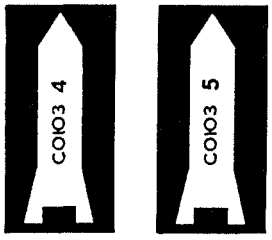
The astronaut continued, "We installed and took off the movie camera's cross bars, set up and later dismantled hand-rails for exit from the orbital compartment and for entrance into the another orbital compartment, set up and took off television lamps and carried out a number of other operations which may be of value in the future. Particularly great effort had to be made for turning the body round some point or other on which your hands had been placed. That was not easy."

Eliseev and Khrunov spent almost an hour in the open in space. Evgenii talked very sparingly about it. However, even about his flying life he spoke very laconically.

"At the time I studied I worked, like everyone else. Sorties? All sorties are interesting. Isn't that so?"

"He has an investigator's nerve, and an inclination for analysis, and

generalization," said Leonov. "Besides, he is a simple and very enquiring person and asks thousands of questions. He never leaves without thoroughly satisfying himself about everything. I was confident that here is a technologically mature engineer who gets equal pleasure whether engaged in theory or practice."



EXPERIMENTAL SPACE STATION

The flight of the "Soyuz-4" and "Soyuz-5" spacecraft took place on January 14–18, 1969. The program envisaged: maneuvering, search, approach, docking and link-up of the spacecraft; the establishment of a habitable experimental space station in orbit; the successful transfer of two astronauts from one craft to the other; complex testing and checkup of systems, units on board and the elements of construction of the spacecraft at the time of separate flight and also as part of the experimental space station.

At the same time a big volume of scientific-technological research was required to be fulfilled: observations and experiments, the working out of outer space navigational methods; observations of geological formations on the earth's surface, the cloud cover, the snow and icebound fields; the detection of cyclones and typhoons; research on the brightness of the earth and stars; medico-biological research on the influence of outer space flight conditions on the human organism were also included in the list of assignments set for the flight.

"Soyuz-4", manned by Pilot-Astronaut Vladimir Aleksandrovich Shatalov, was launched on January 14, at 1030 hours from the Baikonur cosmodrome. It was put in an orbit with the parameters (at the start): apogee—225 kilometers, perigee—173 kilometers, inclination of the orbit 51 degrees 40 minutes, period of orbiting the earth—88.25 minutes.

Twenty-four hours later, on January 15 at 1005 hours the spacecraft "Soyuz-5" was launched, which joined the orbit at 1014 hours. On board were: the commander, Boris Valentinovich Volynov and crew members Flight Engineer Aleksei Stanislavovich Eliseev, Kandidat of Technological Sciences and Engineer-Investigator Evgenii Vosil'evich Khrunov.

The parameters of the "Soyuz-5" orbit were: apogee—230 kilometers, perigee—200 kilometers, inclination of the orbit—51 degrees 40 minutes, period of orbiting the earth—88.7 minutes.

In accordance with the flight program, V. Shatalov carried out observations and took photographs of the cloud cover and the earth's surface, observed geophysical objects on the earth's surface, also the shining particles, took photographs of daytime and dusk horizons of the earth and conducted TV transmissions. He corrected the orbit twice on January 14 and 16 after orienting the craft with the manual control system. As a result "Soyuz-4" started flying at the heights of 201–253 kilometers.

The crew of "Soyuz-5" also fulfilled an extensive program of scientific research. People on the earth saw television reports sent from the orbital compartment and from the astronaut's cabin.

The later analysis of the photographs of the earth's horizon and the data of spectral measurements taken by the "Soyuz-5" crew, allowed for the first time the objective establishment of the color gamut or dusk halo and a detailed characterization of its color shades.

At the end of the first day's flight B. Volynov carried out manual orientation and switched on the course-correction engine unit for changing the orbit with the aim of meeting "Soyuz-4". "Soyuz-5" started flying at the heights of 211–253 kilometers. As a result of corrections the distance between them on January 16 came down to a few kilometers. This permitted the automatic approach system to come into action. At 1037 hours the approach of the craft started.

In the present experiment "Soyuz-4" was the "active" craft. It carried out all the necessary maneuvers for approaching "Soyuz-5". The "active" linkup unit—the bar—was fixed on it. "Soyuz-5" had the "passive" linkup unit—the reception cone. V. Shatalov controlled the approach with the instruments, through optical visor and television installations.

When the distance between the craft came down to 100 meters, Shatalov and Volynov changed over to manual control and at 1120 hours the linkup was successfully completed. At this time "Soyuz-4" and "Soyuz-5" were flying over USSR territory, inside the zone of radio vision of the earth's

tracking points. Hence we were able to see the process of linkup, which was transmitted with the help of the external TV cameras of the spacecraft.

At the time of docking of the craft, their relative velocity was a few tenths of centimeters per second. At the moment of docking, the bar of the linkup mechanism of "Soyuz-4" entered the socket of the reception cone of "Soyuz-5". Mechanical clawing of the crafts, their firm tightening and joining of electrical circuits took place.

Thus the world's first experimental space stations, consisting of two astronaut's cabins, two orbital compartments for scientific research and rest and two instrument-assembly sections, with a total volume of 18 cubic meters of usable space, started functioning in a near-earth orbit at the heights of 209–250 kilometers. Its weight was 12,924 kilograms. A telephone connection was working between the habitated sections; the station could be controlled from either of the cabins. Then the workability of the station was checked. Boris Volynov carried out the necessary turns in space by using low-thrust engines and oriented the station into a given direction. In control the station was as maneuverable and obedient as the separate craft.

A number of practical problems, including the organization of communication between the sections, checkup of instruments and apparatus, systems of electric supply control and orientation, were solved as a result of this experimental flight of the station.

The next important moment in the flight program was the exit of Evgenii Khrunov and Aleksei Eliseev into open space and their transfer to "Soyuz-4". E. Khrunov and A. Eliseev moved from the "Soyuz-5" astronauts' cabin to its orbital compartment and got into their spacesuits at a time when "Soyuz-4" was on its 35th circuit, and "Soyuz-5" on its 19th. Volynov helped them in putting on pressure helmets, gloves and the independent lifesaving systems.

After returning to his place of work in the cabin, Volynov closed the inner hatch, depressurized the orbital compartment and opened the exit hatch. At this moment the orbital station was flying over South America. E. Khrunov came out of the compartment into open space, looked around and then, holding the hand rails, started moving towards "Soyuz-4".

Shatalov released the pressure of his craft's orbital compartment and opened the hatch to receive the astronauts. Eliseev followed Khrunov's actions and forward movement and at the same time conducted a telephone conversation with him. Eliseev started on his path to "Soyuz-4" after Khrunov had completed his transfer. Khrunov kept track of Eliseev by leaning out of the orbital compartment of "Soyuz-4" and maintaining communication by telephone. Both commanders followed the movements of the astronauts with the help of optical visors and external television cameras and talked with their comrades on the telephone.

The exit, work in outer space and transfer of Eliseev all took place over USSR territory and were transmitted to the earth by television cameras, fitted on the external surface of the craft. While they were in open space Khrunov and Eliseev inspected the linkup units and tested the possibility of carrying out assembly operations in outer space. They carried out visual observations and took movie and still shots.

After staying in open space for an hour the astronauts came over to "Soyuz-4". Shatalov closed the hatch. When pressure in the orbital compartment reached the given magnitude, Eliseev and Khrunov opened the visors of their pressure helmets and started taking off their spacesuits. Shatalov helped them. Then Eliseev and Khrunov sat at their working places next to the craft commander and set about further experiments.

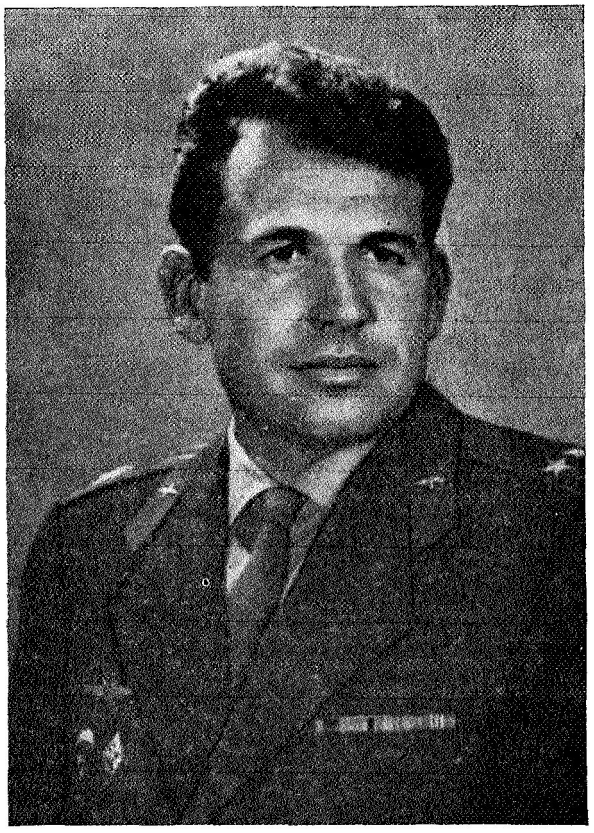
In accordance with the flight program "Soyuz-4" and "Soyuz-5" were delinked at 1555 hours on January 16 after testing the functioning of systems on board the station, then continued their separate flights.

"Soyuz-4" landed 40 kilometers NW of Karaganda on January 17 at 0953 hours. The duration of Shatalov's flight was 71 hours 23 minutes. Eliseev and Khrunov spent 47 hours 48 minutes on their outer space sortie.

Boris Volynov continued his flight. After completing the set program, "Soyuz-5" with Volynov on board landed at 1100 hours on January 18 at a place 200 kilometers SW of Kustanai. The "Soyuz-5" flight time was 72 hours 55 minutes.

The flight of the "Soyuz-4" and "Soyuz-5" spacecraft was ensured by the command measurement complexes on the earth and by a chain of measuring point, situated on the territory of Soviet Union. The "Morozhovets" and "Nevel" research ships of the USSR Academy of Sciences also took part in the work. They were in the region of Guinea Bay. Also at this time the ship "Astronaut Vladimir Komarov" was in the NW Atlantic Ocean and participated in this task.

Many practical problems having great significance for the creation of orbital stations with scientists on board, were solved as a result of the successful outer space voyages of "Soyuz-4" and "Soyuz-5". A number of questions connected with further interplanetary voyages were also answered.



Georgii Stepanovich Shonin,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On October 11, 1969, in the Soviet Union, a launch rocket with the "Soyuz-6" spacecraft blasted off. At 1419 hours the craft "Soyuz-6" was with great accuracy put in the calculated orbit of a satellite of the earth.

The "Soyuz-6" spacecraft was piloted by Lieutenant Colonel Georgii Stepanovich Shonin with Valerii Nikolaevich Kubasov, Kandidat of Technological Sciences as the Flight Engineer.

"Soyuz-6"

For successfully carrying out a group flight of the "Soyuz-6", "Soyuz-7" and "Soyuz-8" spacecraft and for displaying bravery and heroism, the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Georgii Stepanovich Shonin, commander of the "Soyuz-6" spacecraft.

* * *

For making an outer space flight in the "Soyuz-6" spacecraft, the title of the "Pilot-Astronaut of the USSR" is conferred upon Georgii Stepanovich, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

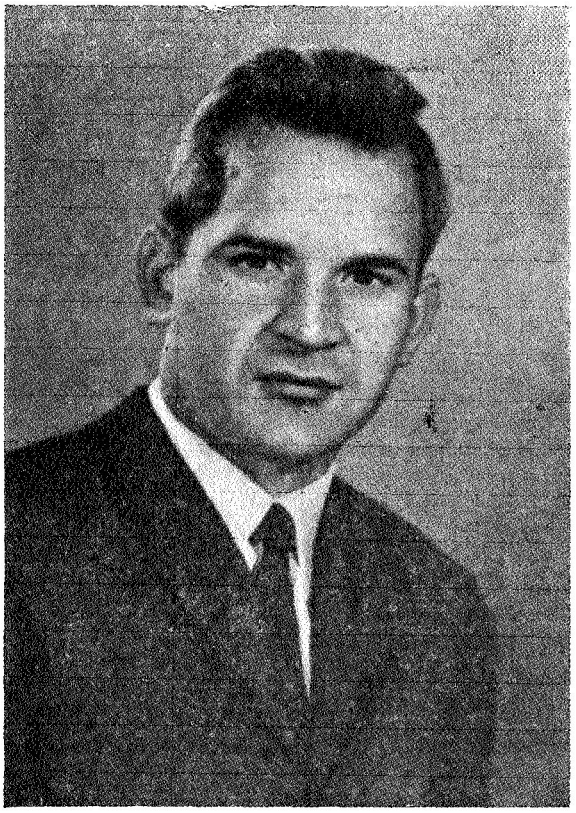
Georgii Stepanovich Shonin was born on August 3, 1935 in Roven'ki, a city of the Lugansk region. His childhood was passed in Balta, a city of the Odessa region. He finished seven years schooling there and became a member of the Leninist Young Communist League of the Soviet Union.

He joined the Odessa Special Flying School in 1950. In 1953 Shonin became a student of the Naval Aviation College. After graduating from it successfully, he has served since 1957 in the air wing of the Red Banner Baltic fleet and later the Northern fleet.

In 1957 the pilot joined the ranks of the Communist Party of the Soviet Union.

G.S. Shonin successfully went through the program of outer space preparation and mastered the construction of spacecraft. While continuing his work he graduated with honors from the N.E. Zhukovskii Air Force Engineering Academy in 1968.

G.S. Shonin was the double of B.V. Volynov, the "Soyuz-5" commander.



Valerii Nikolaevich Kubasov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

The crew of the spacecraft "Soyuz-6" consisting of Lieutenant Colonel G.S. Shonin and Flight Engineer V.N. Kubasov completed experiments involving welding operations in outer space on October 16, 1969. The aim of these experiments was to determine the properties of various metals welded.

"Soyuz-6"

For successfully carrying out a group flight of the "Soyuz-6", "Soyuz-7" and "Soyuz-8" spacecraft and for displaying bravery and heroism, the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Valerii Nikolaevich Kubasov.

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For making an outer space flight in the "Soyuz-6" spacecraft, the title of the "Pilot-Astronaut of the USSR" is conferred upon Valerii Nikolaevich Kubasov, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

Valerii Nikolaevich Kubasov was born on February 7, 1935 in Vyazniki, a city of the Vladimir region.

He joined the Moscow Aviation Institute in 1952 after completing higher secondary school.

After successfully graduating from the Institute since 1958 he has been working in a designs bureau. He defended his thesis for the degree of Kandidat of Technological Sciences.

In 1968 he joined the ranks of the Communist Party of the Soviet Union.

V.N. Kubasov underwent the whole training program of outer space preparation in the astronauts' detachment. He was A.S. Eliseev's double.

TOWARD THE CHERISHED GOAL

HERE are a few sentences preserved in a journalist's notebook. "Gagarin about his friend Georgii Shonin. Served together. Came to the detachment together."

...This is one of the last entries in our meetings with Yurii Alekseevich.

We were sitting at Gagarin's. We talked about a lot of things and, of course, about the forthcoming space flights.

Among those who were named by Yurii Alekseevich, as future commanders of spacecraft was Georgii Shonin.

"I can tell you a lot about Georgii," observed Yurii Alekseevich. "You see, we served together in the North, almost at the same time passed the selection for the astronaut's detachment, together came to the 'Star City'. Both of us started our studies in the first group of future astronauts.

"After the Eisk school, Georgii served in the Baltic fleet. Like Pavel Belyaev he was a naval pilot. Later he was transferred to our fighter unit. I often met the young, jovial, energetic pilot in the officers' club and at the sports meets.

"We got to know one another closer and I learnt that this pilot also dreamt of outer space. I was able to pass the medical examination before him. When I came to know that he had also passed I was happy for my comrade from the bottom of my heart."

* * *

...Georgii was born in Roven'ki, a city of the Lugansk region. He passed his childhood in Balta.

Do you remember Eduard Bagritskii's lines from "A thought about Opanas"?

Balta is a city clean and cozy,
A city as it should be.
Nowhere would cherries be more rosy,
Or sweeter the grapes be.

The city is an old one, founded in 1797. The word "Balta" is of Turkish origin. In Russian it means pole-axe, an ancient deadly weapon in the form of an axe with a long handle. The city has a small clothes factory, a furniture enterprise, sheepskin-coat factory, a cheese-making factory, tile and brick kilns and other industries. Partisans made their hideouts in the nearby forest during World War II.

Georgii lived in his grandmother Mariya Petrovna's house in Balta together with his mother Sof'ya Vladimirovna, brother Oleg and sister Dzhul'etta. Stepan Vasil'evich, his father, went to the Front during the first days of the war and was never heard of again. Later it was known that he had died.

The boy saw a number of tragedies during the period of Nazi occupation which lasted slightly over two years. The Nazis behaved like wild beasts. His grandmother hid in her house a Jewish family—mother and son—at the risk of her life.

The deliverance day, March 29, 1944, came as the greatest, unforgettable festival in the life of the inhabitants of this city.

Georgii studied diligently and with love. This love for study remained with him forever. We inspected with curiosity the printed document about cadet G.S. Shonin, who was excellent in studies. There is a photograph of a young boy in sailor's uniform. On his chest there are medals, which prove the future naval pilot's mastery. In the document Georgii was shown as an example for others. The personal file of cadet G.S. Shonin is his best military recommendation.

There is a concise description of 23 prizes received by the young aviator for his zeal in study, service and irreproachable conduct. The documents also give an idea about the Young Communist Leaguer Shonin as a man. In them it is said, *inter alia*: "Being himself excellent in studies, military and political training, Cadet Shonin like a true and worthy YCL member,

energetically strives for the success of his unit, helps his comrades in service in mastering the theory and practice of aeronautics, and assists the commander in maintaining the regulation discipline.

"The diploma of the Central Committee of LYCLSU, which was awarded to Cadet Georgii Shonin, speaks about the fruitful results of his selfless military service and active social work, giving him his true worth.

"The YCL bureau, led by this excellent cadet, improved its discipline considerably and achieved good results in theoretical subjects."

The years of study! The number of difficulties to be overcome on the path to the cherished goal was not small. But Georgii perseveringly advanced along his chosen path. He wanted to fly and had a desire to dedicate himself fully to aviation.

Shonin is remembered in the Eisk Lenin Order Higher School for Pilots, which has now been named after Pilot-Astronaut V.M. Komarov, twice Hero of the Soviet Union. His classmate Oleg Adov and ex-Instructor Pilot Yurii Rybchinskii work there...

"All of us," recollects Adov, "set about attaining mastery in flying. Georgii Shonin liked to go into the Honors Room. Heroes of the Soviet Union, people in naval pilots' uniforms looked at us from the stands: more than 200 heroes had studied in our institution. Five of them were twice awarded the title of Hero of the Soviet Union. One cannot forget them—Kuznetsov, Mazurenko, Stepanyan, Rakov, Chelnokov. All of us were proud of the fact that Lyapidevskii, Levanevskii, Molokov and Doronin were cadets in our school. The pilots, who brought victory to the Soviet motherland during the Second World War, taught us and told about their sorties during the war..." They were people to be imitated, and set as examples to the cadets.

Georgii Shonin studied with diligence and perseverence. Every "excellent" grading gave him pleasure; "good" was not good enough for him. Mere "satisfactory" grading he never got. During the days and hours free from classes there was a lot to do: reading, hobbies, meetings with the city youth.

There was a children's home in the city. It was fun to visit the orphans. He himself had lost his father during the war and soldiers' hands had raised him and given him love. Georgii visited the children's home. The boys and girls would cluster round, show him their drawings, aircraft models and embroidered napkins. The cadet played with the children, drew airplanes for them and sang songs together with them.

When Shonin became an astronaut, journalists asked him:

"Which was the most memorable day of your life?"

The answer was:

"April 18, 1954. It was the day I went up in the YaK-18 aircraft for my first solo flight. The sun was shining brightly. And everything inside me was rejoicing. I worked accurately like an automatic machine. But I had to sweat a lot before this day of my dreams dawned.

"Once my grandmother, a person who had suffered a lot, said about pilots: 'They do not earn their bread easily'. It is not simple to become a pilot. Experienced and clever pilots can transform a young flier into a real aviator. I shall remain thankful throughout my life to Senior Lieutenant Polyakov, who taught me to understand aviation and flying."

"Who among the people is your ideal?"

"Probably I will repeat what many others have said. Valerii Chkalov is the standard by which I measure my life. He was brave, cool, decisive, calculating, careful and daring. He had an exuberant nature. He could not think of himself without aviation. He was created for it. The whole of his life is an example of service to the motherland and people of Russia. The French pilot Saint-Exupery. I read his books with great interest. Of course, he is a person quite different from Valerii Pavlovich, but how much of fearlessness and wisdom he had. And in his motherland few people knew him. He was engaged in simple, ordinary work. By the way, such work takes a major place in the life of each one of us. But how Saint-Exupery wrote about it? One has to be born a pilot. Many of my friends had good knowledge of theoretical subjects and sincerely loved aviation. But when the flights started... many of them fell out."

"You have a craving for outer space, is this not a betrayal of aviation?"

"No, no. This craving is quite natural. I have flown in many aircraft. I think that the flying rockets are a continuation of aviation. The conquest of outer space is a natural process, which has its source in human requirements. It will be developed in future."

"Where were you when Yurii Gagarin flew in outer space? What did you think of at that moment?"

"I was at one of the communication bases. But unlike Aleksei Leonov I could not speak to him. I was happy and being human envied Yura a bit. But I knew that my turn would also come. All these years like my comrades I always prepared for the start. What did I think of during those memorable minutes, what was my desire? Yura's safe landing..."

* * *

"In the detachment I had the opportunity to see a number of excellent qualities in Georgii as a man and as a pilot," Yurii Alekseevich continued his story that day. "He has strong will-power, is intelligent and persistent in study and training. Normally he worked in heavy doses. We observed several times that if the situation and program of study demanded it he could stretch himself to the fullest extent."

Shonin had to go through the same program in the detachment as the other canditates. At one time he reacted badly to the centrifuge, but later every thing was O.K. Persistent training had its effect. The organism got

accustomed to heavy loads, the unpleasant feelings of the first days were forgotten and only notes about them remained with the doctors.

The old guards of the detachment recollect that on the "running track" Shonin showed his first class qualities to the maximum. The tape moves quicker and the astronaut also runs at a faster pace so as not to be thrown off. The speed is increased. Four...five...six...seven...eight meters per second.

When Georgii came off the trainer, one of the comrades cut a joke:

"You were supercharged!"

We will add that Shonin loved being "charged with speed" even while serving as a naval pilot in the Baltic. There during the summer sports meet of the military units, he got first place in the 1500 meters race with a time of 4 minutes 52.3 seconds.

"Who among the fliers is similar to Georgii?" asked Gagarin. "Perhaps, no one. This includes those who have yet to fly. All the people are different, everyone has a clearly marked individuality."

...When our conversation with the first astronaut took place, Shonin was still a student of the N.E. Zhukovskii Air Force Engineering Academy. Yurii Alekseevich stressed that his comrade studied only for "excellent" gradings. Simultaneously with the mastery of the outer space program Georgii studied on his own in the Academy those portions which his comrades had not yet learnt. He took parallel examinations, planned ones and those over and above the planned courses. Is this not a proof of persistence and the ability to work independently?

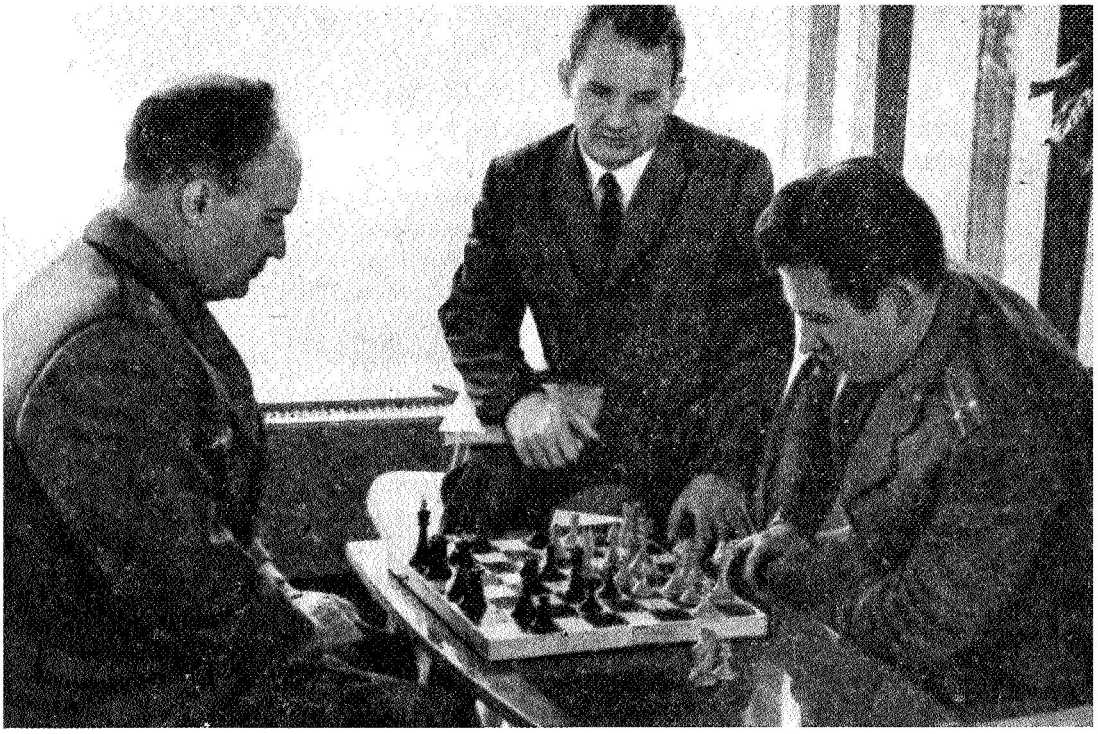
"Georgii is a good sportsman," continued Yurii Alekseevich. "His passions are volleyball and basketball. He also swims very well and plays hockey as a past master. He loves movies, fine arts, and is himself not a bad artist. At one time he was a member of the editorial board of the detachment paper 'Neptune'. A big theater fan: he had a special weakness for theater.

"For complete characterization I will add: Shonin is a very sociable man. When you live heart and soul with the collective, it is a great thing. Georgii has great prestige among us."

Shonin's best friend, Andriyan Nikolaev, has a story about him which serves as a good illustration of what Gagarin said.

"During my first day on joining the detachment I got acquainted with Shonin. A calm, modest, hard-working and considerate person. We passed our bachelor's life together. I never thought he would get married before me. He kept away from girls. But when he went on leave he sent me a 'Getting married telegram'. I, of course, congratulated him, but thought in my heart, 'Did the boy not hurry things up?' Later I was reassured. I looked at the life of the young couple and was certain that they had a good family life. I visited them very often, as I visited the Bykovskii couple.

" I had very strong ties with Georgii. We were always frank. We had much



A chess game
From left to right: N.P. Kamanin,
V.N. Kubasov and G.S. Shonin.

in common in our views on life. We agreed in the main thing: the best qualities in a man are simplicity and honesty.

"A little before my flight, Georgii's son was born. At that time he told me:

'You know, we want to call our son Andrei in your honor, to honor our friendship.'

"I was deeply touched by such affection. I thanked him heartily. Thus my little namesake appeared in the 'Star City'."

* * *

These words of Yurii Gagarin come to our mind again and again:

"Georgii used to come to the Baikonur cosmodrome to watch the spacecraft being launched. He could clearly picture to himself how the craft, in which he would one day set out for outer space, would start. During flights Shonin visited various places in the country, observing how the astronauts carry out the planned program.

"You are interested in Shonin's reaction to his friends' flights. Certainly he as well as others wanted to occupy his place in the spacecraft cabin. But Georgii was always happy in his heart at his comrades' successes."

And on October 16, 1969 at 1252 hours Moscow time, the spacecraft "Soyuz-6" landed in the Karaganda region. Commander of the craft Georgii Shonin and Flight Engineer Valerii Kubasov were clasped in the arms of the welcomers. The time to congratulate Georgii had come. The astronaut's dream had been realized, he had reached his cherished goal.

FLIGHT ENGINEER OF "SOYUZ-6"

THE assembly hall of Moscow University was jam-packed. Not all the journalists could be accommodated in the press seats. Many people sat on the steps of the staircase leading to the presidium. The small microphones belonging to the journalists had been fixed on the rostrum itself. They numbered over twenty. The photo, movie and telecameras were aimed at the first outer space electric welder—Valerii Nikolaevich Kubasov.

"If you please," the presiding officer of the press conference, president of the Academy of Sciences M.V. Keldysh turns to the astronaut.

"As the flight engineer of 'Soyuz–6'," starts the astronaut, "I had to directly participate in carrying out a unique experiment—the completion of welding jobs in outer space."

The hall applauds warmly. The astronaut is of medium height, the Hero's Gold Star shines on his dark suit. His brown eyes smile. After the hand clapping comes to an end, he continues his speech.

"Already at present the development of astronautics has put before our scientists and designers problems connected with the creation of big orbital

stations and interplanetary craft from parts taken to the near-earth orbit. In future the outer space apparatus, which stay in flight for prolonged periods, will have to be repaired. The necessity of joining metals, including joining by means of welding, is a must for such jobs. Welding as a technological process has a number of peculiarities of its own. Different metals can be joined, cut or locally heated with the help of one and the same instrument, say an electronic beam instrument."

* * *

...It seems as if only recently Valerii Kubasov wrote his autobiography which, by the way, would fill only half a page of a school note book:

"I was born on February 7, 1935 at Vyazniki, a city in the Vladimir region. I have been living there all my life.

"I joined primary school in 1942 and later studied in secondary school, which I completed in 1952.

"Since February 1949 I have been a member of the LYCLSU...and was engaged in social work too..."

At that time the author of the biography had nothing else to state. He had just completed 17 years. But even then he knew clearly what he would be doing for the rest of his life: he would build aircraft.

"What led you to aircraft construction?" Kubasov was once asked.

"It is difficult to answer offhand. I chose this profession when I was half my present age."

"But now would you choose a different path?"

"No, no," he hurriedly answered, "I just wanted to say that many circumstances influenced my choice of profession."

V.V. Nikolaeva-Tereshkova, who was standing by our side, observed that life itself pushed every man to select a definite path.

"I became a weaver because my mother advised me. In our textile area we have such traditions. From one generation to another whole families work in textile or other factories.

"Perhaps the same thing happened to me too," Kubasov agreed. "My father was a mechanic. From early childhood I lived in the world of nuts and bolts. I myself was always trying to rig up something or the other. Technology was the constant topic of conversation at home. The school and technological hobby-groups also had their place..."

The young man's dream took shape because of his family, school, stories about pilots who fought on the Front, or maybe because of the fact that this Vladimir city was the birthplace of the wonderful Russian scientist Nikolai Egorovich Zhukovskii, who was called the "father of Russian aviation" by Lenin. The scientist used to go to Orekhov up to the last days of his life. This place is near Vladimir. Here he would carry out innumerable

experiments, solve difficult mathematical problems and write his famous work on the theory of aviation.

There was not a single schoolboy who had not heard of Zhukovskii, who was not proud of his great fellow-townsman. Valerii read with interest books and articles about another scientist of Vladimir, Aleksandr Aleksandrovich Mikulin, one of the most famous designers of aircraft engines. The brilliant flight of Soviet pilots to America via the North Pole in ANT aircraft and the crushing blows of Il'yushin aircraft on the Nazi armies are also connected with Mikulin's name.

So it is also possible that the dream to become an aviation engineer was given wings by the swift aircraft, drawing intricate figures in the sky over his native Vyazniki.

Valerii Kubasov stood near a massive building on the Volakolamsk highway on a summer day in 1952. The Moscow Aviation Institute had already the Order of Lenin affixed to its banner as an acknowledgement of its enormous services in the training of specialists for the aviation industry. Hundreds of its graduates had been awarded the highest State decorations.

Valerii with other young boys and girls passed through the institute courtyard, which somehow reminded one of a factory courtyard. On his right and left were buildings resembling workshops. And then he came to the square with Sergo Ordzhonikidze's sculpture. The institute has been named after him. The young boy went up a narrow staircase to a corridor and searched for the signboard "Selection Committee".

The secretary of the committee, an elderly lady took his documents:

"Are you a medalist?"

"Yes, Silver...couldn't stretch out long enough for the Gold."

The secretary, through whose hands hundreds of applications had passed, looked keenly at the documents, and glanced again at the certificate.

"Well now, it's O.K. You have excellent marks in the exact sciences. Well done!"

Valerii joined the institute without going through the entrance competition. At the time of interview, the young man's aptitude for mathematics attracted the teacher's attention. The problems set to test quickness of wit were solved by Kubasov unhurriedly, but thoroughly. He even drew a projection of the figure.

The first days of study in the institute have been preserved in his memory for ever, especially the traditional address to the students by the Rector, the famous scientist Ivan Filippovich Obraztsov.

He said, "The modern engineers must have deep theoretical and practical knowledge. It is necessary to know the latest achievements in the fields of physics, chemistry, automatic machines, electronics, metal sciences and many others very well for creating technology."

The scientist called upon the students to become engineers of wide profile, capable of solving difficult research and design problems successfully.

The path of knowledge was not an easy one. The future engineer studied experimental aerodynamics, metal sciences and heat treatment, hydraulics and analytical geometry...and a number of other things. The compulsory labor in the workshops must be added to this. There the students learnt metal work, casting and forging. Five and a half years of concentrated studies. As a rule, Kubasov's examination card carried only "excellent" gradings.

The beginning of the space era was announced to the world by a Soviet satellite in October 1957. During those days the thought about finding himself a place in the conquest of outer space was born in Valerii's mind and it kept on growing stronger.

A year was left before graduation from the institute. This was the most crucial year. The diploma thesis was to be defended.

The teachers' collective of the institute included scientists and designers who imparted knowledge to the young people, but at the same time left full scope for independent creative work by the students. As a rule the course and diploma projects were based on topics suggested by industry and contained elements of scientific research.

Valerii Kubasov took up a difficult problem for his diploma work. This is what the examiners wrote in their verdict on the diploma thesis:

"...The candidate took up his work on the thesis creatively. The simplicity of preparation and elaboration are some of the virtues of this project.

"...Comrade Kubasov has taken the initiative in solving a number of problems in the process of his work on the project and has not fallen back on the familiar schemes and constructions but has worked out an original system."

And at last the illustrious day—the defence of his diploma thesis. The director Professor A. Abibov said:

"Student Kubasov received only the highest marks in the subjects of the department of technological production of flying apparatus. I remember how calmly and confidently he made the report about the topic of his diploma thesis. The committee gave him 'excellent' grading unanimously."

Valerii was given the Diploma of Engineer Mechanic of Aircraft Construction.

The institute gave one more start in life to the young engineer, a testimonial signed by Professor I.F. Obraztsov, Rector of the institute.

"During his studies at the institute," says the certificate sent to his place of work, "V.N. Kubasov was found to be a capable and successful student. He studied the required subjects systematically and deeply. During practical training at the factory, where with a group of comrades he was able

to complete a complex construction and get it going, Comrade Kubasov commended himself very well."

The young engineer came to a creative collective, where some models of space technology were being developed. V. Kubasov started his work with unusual energy. The sound knowledge of mechanics, ballistics and aerodynamics received in the institute, helped him to get the feel of the work quickly. Academic work started attracting the young engineer more and more. And the result was an original contribution, for which the engineer was later awarded the degree of Kandidat of Sciences.

The deeper Valerii Kubasov understood the essence of the impressive plans of outer space research, the more energetically he participated in the creation of space technology. Somewhere in his heart of hearts he wanted still more—to go into outer space himself, to check for himself how the instruments and systems constructed by his own labor, function in flight. This desire became all the more strong after K.P. Feoktistov had worked on board the "Voskhod".

"It became clear to us," Kubasov recollects, "that the path into outer space was open for specialists too. During those days Academician Korolev, who was a supporter of the flight of engineers into outer space, said, and I remember his words by heart: 'From now onwards after Feoktistov's flight the way into outer space is open to scientists. Now they will not have to depend just on figures and instrument recordings, photo- and tele-metric films and pilots' evidence. No, now their own live perception of events, the feelings of having seen and suffered themselves are available to them. Hereafter they have the attractive opportunity of carrying out experiments in the way they like, there itself analyze the results received and move forward.' After this I didn't have any peace."

In the middle of 1966 an engineering group of outer space explorers was formed. Specialists of various profiles constituted this group. Among them were Aleksei Eliseev, Vladislav Volkov and Valerii Kubasov. All of them had undergone training and flight preparation like the other astronauts. Centrifuge, rotor and vibrostand, flights in jet aircraft with an instructor, parachute jumps, the ordeal of weightlessness in the "flying laboratory"—this does not exhaust the long list of "subjects", which one has to pass before a board of strict examiners, to qualify for a journey into outer space. In addition to all this, Kubasov had to study electric welding apparatus and master the art of the electric welder.

Kandidat of Technological Sciences, V. Kubasov has dedicated the rest of his life to outer space. He is the author of a number of research papers. His work "Correction of interplanetary trajectories with the help of impulses of radial heliocentric speeds" became famous. It was published in the "Outer Space Journal" of the USSR Academy of Sciences.

This scientific paper investigates the method of correction of interplanetary

trajectories, proceeding from the assumption that a space apparatus gets impulse velocity along the line joining it to the sun. V. Kubasov not only analyzed the peculiarities of such corrections but also worked out the method of their calculation.

At last in January 1969 the day dawned when Aleksei Eliseev went into outer space. Oh! How happy his double Valerii Kubasov was then! And ten months later, although on board different craft they went into outer space together to participate in a group flight...

* * *

The press conference continued. After telling us about the results of his work in outer space, Valerii Kubasov answered journalists' questions.

"Can the device 'Vulkan' be used for carrying out welding on the surface of the craft?"

"The device 'Vulkan' is meant primarily for research in various methods of welding and the selection of the most optimal (for carrying out varied jobs) from among them. Experience shows that welding is possible in outer space."

"What prospects for national economy does welding in outer space present?"

"Astronautics and, in particular, the experience of welding in outer space naturally presents new opportunities and prompts interesting technological solutions in the various branches of our manufacturing industries."

"How do you evaluate the working of 'Vulkan', the welding device produced by Soviet specialists?"

"The 'Vulkan' mechanism worked excellently. If necessary its elements can be used for repair jobs in outer space. The selection of a concrete method of welding depends on the type of the job."

"What are the next steps in mastering welding techniques and in utilizing new methods of welding in outer space?"

"The problem of constructing a big sized space orbital station already stands before the scientists and designers. Welding operations on a large scale will be used at the time of their construction. Purely metallurgical operations, e.g. the receipt of metals of extremely high purity, the development of various single-crystals, etc., are also possible in outer space."

...A new question ... an exact answer scientifically based and confident. Such an answer could only be expected from a scientist and a specialist who knows his job thoroughly. Valerii Nikolaevich Kubasov is precisely one of these.

"Soyuz-7"

For successfully carrying out a group flight of the "Soyuz-6", "Soyuz-7" and "Soyuz-8" spacecraft and for displaying bravery and heroism, the title of the Hero of the Soviet Union with the award of the Order of Lenin and the Gold Star Medal is conferred upon pilot-astronaut Anatolii Vasil'evich Filipchenko, Commander of the "Soyuz-7" spacecraft.

* * *

For making an outer space flight in the "Soyuz-7" spacecraft, the title of the "Pilot-Astronaut of the USSR" is conferred upon Anatolii Vasil'evich Filipchenko, a citizen of the Soviet Union.

* * *

FROM THE HERO'S LIFE

Anatolii Vasil'evich Filipchenko was born on February 26, 1928 in the village of Davydovka in the Voronezh region.

In 1942 he completed seven years' schooling in the city of Ostrogozhsk. He started working in a mill from 1943 onwards as lathe operator.

An interest in aviation led Anatolii to the Voronezh Air Force School. After getting his school leaving certificate he joined the Chuguev Air Force Flying College. After three years his service in Air Force units started.

He joined the ranks of the Communist Party of the Soviet Union in 1952.

In 1961 he graduated from the Air Force Academy.

In the astronauts' detachment, he was Vladimir Shatalov's double.

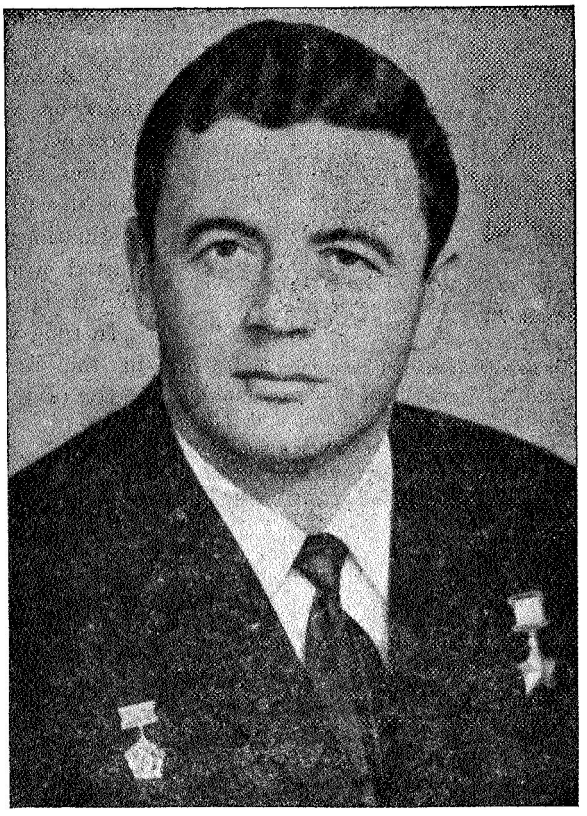
1966—1971

Anatolii Vasil'evich Filipchenko,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

Continuing the planned program of scientific-technological research and experiments by the "Soyuz" spacecraft, on October 12, 1969 the spacecraft "Soyuz-7" was launched in the Soviet Union.

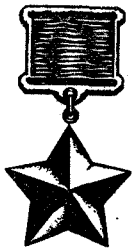
The crew of the spacecraft is commanded by Lieutenant Colonel Anatolii Vasil'evich Filipchenko, and is composed of Flight Engineer Vladislav Nikolaevich Volkov and Engineer-Investigator Lieutenant Colonel Viktor Vasil'evich Gorbatko.



Vladislav Nikolaevich Volkov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

On October 13, the crew of the spacecraft "Soyuz-7" carried out observations and photography of the earth's surface, the day and dusk horizons, and also worked the devices of independent navigation. In accordance with the program, radio and television transmissions from the spacecraft were carried out.



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* * *

FROM THE HERO'S LIFE

Vladislav Nikolaevich Volkov was born on November 23, 1935 in Moscow.

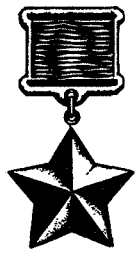
After secondary school he joined the Moscow Aviation Institute. On graduating from the Institute he started working as an engineer in the designs bureau.

In 1965 V.N. Volkov was accepted in the ranks of the Communist Party of the Soviet Union.

Viktor Vasil'evich Gorbatko,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

By 1630 hours on October 13, astronauts A.V. Filipchenko, V.N. Volkov and V.V. Gorbatko had carried out a large volume of scientific, technological and medical investigations on board the spacecraft "Soyuz-7".



"Soyuz-7"

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* * *

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* * *

FROM THE HERO'S LIFE

Viktor Vasil'evich Gorbatko was born on December 3, 1934 in the Ventsy-Zarya settlement of the Krasnodar Territory.

After completing secondary school Viktor joined the Air Force Aviation School for preliminary training in 1952, but the next year he went to the Bataisk Air Force Flying College.

From 1956 onwards he served in aviation units.

In 1959 the party organization of the unit admitted V.V. Gorbatko into the ranks of the Communist Party of the Soviet Union.

He underwent training as E.V. Khrunov's double.

In 1968 while continuing his work he graduated from the N.E. Zhukovskii Air Force Engineering Academy.

THE CHUGUEV TEMPERING

It is an interesting fact that exactly five years to the day after an inhabitant of Voronezh, Konstantin Feoktistov, started for outer space, another son of the Voronezh land, Anatolii Filipchenko, went up. For these two follow-townsmen, October 12 became one of the most important days in their lives.

Addressing the people assembled at the launching site, the commander of the "Soyuz-7" craft, Lieutenant Colonel Anatolii Vasil'evich Filipchenko said:

"Dear Comrades and Friends!

"Yesterday we saw off into outer space our comrades Shonin and Kubasov, and today we are ourselves leaving for the vasts of the universe in our 'Soyuz-7' craft.

"Our country is carrying out the research and conquest of outer space confidently and systematically, and we are proud that we are also making a contribution to this noble task.

"We heartily thank the Central Committee of our Party and our

Government for the faith put in us and assure them that we will use all our knowledge and will leave no stone unturned to fulfill the tasks set before us.

"And now 'Goodbye!' "

Applause burst out, kind wishes for a good journey and happy landings were being shouted, and somebody even wished fair wind, which was followed by friendly laughter.

And now the climax in an astronaut's career: the exciting moment of launching has come. The girders holding the rocket are removed. The huge "cigar" hurtles upwards with giant force. The fiery spout had already disappeared; the mighty rocket rushed "Soyuz-7" higher and higher. The television cameras inside the cabin of the craft showed pictures of Anatolii Filipchenko and his comrades Vladislav Volkov and Viktor Gorbatko. They were smiling.

Earth broke in:

"This is 'Zarya'. How are you feeling?"

"This is 'Burin'," answered Filipchenko. "We are fine. Everything is in order. All is O.K."

"Per ardua ad astra" says the pilot, but how much more difficult is the path for an astronaut to the stars.

Anatolii Filipchenko came to astronautics after being tempered in the sky. The future astronaut got the real feel of aviation at the Chuguev College. The Voronezh Air Force School he had already passed. Now he had to learn to fly to qualify for the profession of his dreams.

"Tolya had a great desire to study, and wanted very much to become a pilot," said Filipchenko's mother Akulina Mikhailovna.

The documents of the special school are preserved in the archives, even the class roster with marks.

"He was a sociable, jolly, diligent young man," recollects the teacher of Russian language and literature E.V. Kruchinina.

His old gymnastics teacher I.S. Rozin characterized his pupil in two words: "A wonderful gymnast!"

The special school gave the young boy secondary education and elementary knowledge about aeronautics, while in the Chuguev College, Anatolii studied seriously and learnt to love the pilot's art.

The pupils were brought up on fighting traditions, having before them the examples of many heroes—former graduates of the famous college. Ivan Kozhedub, himself a Chuguev pupil, thrice Hero of the Soviet Union, worked as an instructor here at the beginning of the war.

In the classes on tactics in air fighting the instructors described Kozhedub's feats, how he had completed 330 strike sorties, had fought in 120 dog fights with the enemy and had shot down 62 enemy aircraft.

Anatolii heard with thrilling interest how Kozhedub had destroyed his 61st and 62nd planes bearing the Nazi Swastika near Berlin.

We remembered that at the time of a meeting of the pupil with the Hero, Ivan Nikitich had spoken in detail about this very engagement.

... The war career of another Chuguev graduate—twice Hero of the Soviet Union, Arsenii Vorozheikin—also fascinated Anatolii Filipchenko and his friends. His record was "8 against 35—shot down 11, loss 0", "6 against 110—shot down 12, loss 0". The fighter ace accounted for 52 enemy aircraft. "To shoot like Vorozheikin" was the motto of many pilots.

Filipchenko studied diligently and flew in aircraft of various types. Kozhedub, Vorozheikin and other Heroes who had attained their flying mastery at Chuguev, served as examples for him and at all times in everything.

Instructor Sergei Petrovich Abalduev, who sent the future astronaut for his solo flight, says:

"Why shouldn't I remember Filipchenko? As if it all happened just yesterday. I helped him to air mastery in three preliminary steps—using the UT-2, YaK-18 and LA-9."

Filipchenko was one of those whom it was easy to teach.

"Capable?"

"Yes."

"Keen-witted?"

"I guess so. But the main thing was he had discipline and could concentrate. Somehow he at once got accustomed to the Air Force pilot's profession, a difficult and essential task. It is not so easy to love the flying routine. Of course there are people who serve from one day to the next always awaiting something unusual. The present day seems secondary compared to the morrow; tomorrow something may happen for which strength must be preserved. Filipchenko on the other hand was concerned with the present and took up any and every rough work willingly, even with ardor. Do you remember what the test pilot Sedov said in this connection? 'If a person going for a flight thinks he is going to perform a heroic feat, it means that he is not ready for such a feat.' "

But Anatolii Filipchenko fulfilled every task conscientiously. Discipline, conscientiousness and YCL fervor were his distinctive qualities. In 1950 he completed the course. The student's excellent record was fully recognized. A part of the young officer's heart was left in Chuguev: it was here that he got his wings.

Filipchenko as an officer and pilot maintained the traditions of Chuguev graduates. A letter from the military unit, which has been preserved by Anatolii Vasil'evich's mother, is a proof of this.

"Vasilii Nikolaevich and Akulina Mikhailovna! We decided to share our common happiness. Your son has achieved excellent success in study and service. He behaves in a manner worthy of a patriot—a soldier of our motherland. We are happy to salute you, the parents who brought up such a son, of whom all his colleagues are proud. Your efforts are responsible to a great

extent for his success. We are sending a photograph of your son near the fluttering Red Banner of the unit."

While perfecting the art of flying and fighting, Anatolii understood that the meteoric growth of technology demands ever increasing knowledge from the pilot.

Knowledge! All his life Anatolii has been craving for it. His parents served as examples: his father, a member of the party since 1918, a party and Soviet worker, participant in both the Civil War and Second World War, as well as his mother. His mother learned to read only after the Revolution; later she finished the workers' high school and became a teacher. Tolya studied in the Ostrogozhsk city secondary school in the Voronezh region where he completed seven classes. But the war had started, his father had left for the Front, and his mother had a difficult time with the little children so the boy started working in the repair factory. At the age of fifteen he got his baptism in labor, to become a lathe operator. He worked shoulder to shoulder with grown-up people. N.K. Puskanin, party organizer of the factory, I.D. Latov, the previous foreman of the workshop, and Filipchenko's lathe operating "Godfather", worker P.F. Kupriyanov, speak very warmly of their charge. Anatolii did not just set an example in production, but also won a lot of respect as an active Young Communist Leaguer.

And Filipchenko got himself enrolled in the correspondence courses of the Air Force Academy, where Ivan Kozhedub had been.

Studies, flying. He had to work without sparing himself. The testimonials given by the senior officers prove that everything went along well: "Flies daringly, with great enthusiasm"; "Has quick reflexes, can clearly and accurately analyze everything taking place in the air."

The regiment commander wrote in the report about Lieutenant Filipchenko: "Hard working, has a serene character, excellent in flying, knows the material, in firing exercises has always the highest marks, has earned respect and authority for himself among the pilots. Elected member of the party bureau of the unit..." Similar testimonials full of praise were also given to the pilot in other units where he served.

Filipchenko flew in many machines—from the first MiG's to aircraft of the latest design. He passed the long way from junior and senior pilot, section commander, deputy, then squadron commander to become Senior Instructor-Pilot of the aviation division.

Anatolii got acquainted with the future astronaut Pavel Belyaev at the Academy, where he had come to take examinations. The latter was a student in the senior classes. Naturally, none of them could foresee at that time that they would become astronauts.

The spring of 1961 was memorable for the officer because of the State examinations. His marks were excellent! However, even before this his examination card had five gradings—all excellent.

Craft commanders A.V. Filipchenko
and V.A. Shatalov.

Gagarin's historic flight in outer space was discussed with ardor by Anatolii Filipchenko and his friends. Then further flights—Titov, Nikolaev, Popovich... The new graduate of the academy continued his service diligently. Sometimes the thought about the astronauts' detachment flashed through his mind, but it seemed to him that it did not have any real basis. Then quite suddenly there was a call to a special medical commission followed by enrollment in the astronauts' detachment.

The days of special study and training had started. He mastered the "Vostok", "Voskhod" and "Soyuz" crafts... He got ready as Boris Volynov's double. Was it difficult? Very difficult indeed. And Filipchenko had the title of Pilot First Class, and had flown over 1,500 hours.

While in the detachment he continued perfecting the art of flying in supersonic aircraft. The result was the title of Test Pilot Class III.

"I think pilot-astronauts," said Filipchenko, "should compulsorily go through the methodology of test flights, because outer space flights are also test flights in their novelty, in the face of unforeseen elements."

The instructor who prepared him for the starry path had this to say about the astronaut:

"Anatolii Filipchenko joined the group preparing for flight in the 'Soyuz' spacecraft, slightly later than the other astronauts. Before this he had no opportunity to get thoroughly acquainted with the craft's design and its systems.

"Filipchenko is a pilot and had no special engineering education. When I started working with him I thought that much time would be needed for Filipchenko to come up to the level of his comrades. At the time of the lectures we felt that he did not understand everything, that much was not clear to him. The fact that he put very few questions to his teachers and instructors also caused us to worry.

"Filipchenko would usually stay alone after the classes and work by himself. It so happened that I had to leave the group for about a month and a half. After returning, I hurried first to talk to Anatolii. I was anxious to know how his training had progressed.

"After the very first talk, I was pleasantly surprised. Anatolii Filipchenko understood all the questions wonderfully and, perhaps, in some he even surpassed his comrades. Undoubtedly all this was a result of his exceptional purposefulness, ability to comprehend the main facts and outstanding aptitude."

The instructor concluded, "In a word, all my doubts and anxiety disappeared. Anatolii Filipchenko proved to be a deserving candidate for the job of 'Soyuz-7' commander and he successfully carried out the varied program of flight preparation..."

It was not surprising that when Georgii Beregovoi was asked who could replace Vladimir Shatalov, if he was unable to fly as commander of the group of "Soyuz" craft, he confidently replied: "Filipp" (to his comrades in the detachment Anatolii was Filipp).

Lieutenant Colonel Filipchenko had service references also, signed by Gagarin and Nikolaev. These documents testified time and again to the strong will and determination of the astronaut, about his diligence, honesty, adherence to party principles, modesty and the desire for perfection.

When Anatolii was congratulated for carrying out his mission so excellently, he said with modesty, "We are only the executors. The designers, engineers, workers, all who created and prepared the craft must be congratulated."

He also expressed this thought at the meeting in the Kremlin Palace of Congresses:

"Every one of our flights in outer space is a result of the heroic labor of the whole of our nation, led by the glorious Communist Party. We pilot-astronauts do not forget this even for a minute.

"The participants of the new group flight underwent great and varied

First press conference.

preparation. Scientists, designers, pilots, physicians, engineers and, of course, our comrade pilot-astronauts who had earlier carried out 'Soyuz' flights, prepared us for this task.

"Permit me to heartily thank the workers of the scientific research organizations, design bureau enterprises, study classes and laboratories and the specialists of the cosmodrome for the knowledge and skill they gave us. It is thanks to their attention and care that we could successfully carry out this flight."

THE WAY TO START

It seems that fate itself prepared Vladislav Volkov for flight, at first in the skies, and then in outer space. Laughingly the astronaut's acquaintances assert that the very first word uttered by him was not "Mama", but "airplane". Every joke has some truth in it.

Vladislav was born in a family dedicated to aviation. His father Nikolai Grigor'evich Volkov was an aviation engineer-designer; his mother Ol'ga Mikhailovna also worked in aircraft-building enterprises. It was natural that an interest in aviation was born early in the boy. And if it is added that the family lived in the region of Tushino Airport, and the neighbors were all engineers and pilots, then Vladislav's desire to become a pilot becomes completely understandable.

"What profession to choose? Sometimes it is not so easy to answer this question," recollects the astronaut. "Sometimes professions competely opposed to one another attract a young man—engineer or physician? agronomist or chemist? I do not condemn those who waver. It is very very difficult to choose one's path in life, to select the work, at the age of seventeen-eighteen,

which you can love for ever. But I was simply lucky. My parents' enthusiasm was passed on to me."

All the same, Vladislav Volkov did not become a pilot right away. Here the family had a decisive say: "First of all high school." How he longed to go up in the air as early as possible! Running to his school Vladislav all the time looked at the sky. Over Tushino the sky was always busy. Making simple figures, the aircraft circled above him. Boys from the local aero club, just like him, were sitting in them and learning to fly. Although the boys only learnt to pilot the light, one-engine aircraft and Volkov's dream was to fly high-speed planes, he understood that the first step was also essential.

Maybe the young man would not have persisted, were it not for one circumstance. Once his maternal uncle Petya—the pilot Petr Mikhailovich Kotov—Vladislav's favorite uncle—a person whom he wanted to emulate, told him firmly:

"Look here, Vladislav: our profession is not just tourist travel in the clouds. It is, my boy, the shield of our motherland."

The pilot, whose feats during the years of the last war were acknowledged by several orders and medals, told the young man for about an hour about how he had taken part in dog fights with the enemy, how he had been a hair's breadth from death a number of times while defending his native country from the Nazis.

"Flying is not an easy affair," said Petr Mikhailovich. "Not every one can fly well. For this deep-rooted knowledge and talent is necessary. Thrice Hero of the Soviet Union, Aleksandr Pokryshkin was a combination of knowledge, flying mastery and bravery. There is one more profession—that of the pilot who gives an aircraft its passport into the air."

"Test pilot?"

"Yes. That is an exclusive profession." Petr Mikhailovich smiled cunningly. "But there is another completely exclusive profession—that of engineer-designer.This is what I would like to become, were it not for my age. Be proud of your father, his labor has been put into the development of many aircraft."

"But I want to fly," Vladislav repeated stubbornly. "Fly like Chkalov, like Pokryshkin."

"But do I oppose that? I only think that you will have time to learn to fly. You won't be delayed. But the engineer's profession is an excellent aid to a test pilot."

Vladislav thought for a long time over the problem of what he should do. The advice of his elders prevailed. But it was not an easy affair. Arrow-like jet aircraft, moving as fast as lightning would appear in the sky more and more. And in his imagination he sat behind the controls. And how could he forget the famous air displays? The first one after the war when the first jets made a cascade of figures, shining in the sun's rays in the depth of the

sky... that was August 1946. The spectacle had a great impact on the eleven-year old boy. Once his father, confident that Vladislav's dream about the sky was not just boyish fancy, told him in the course of a long talk:

"Remember one thing, Vladislav: one has to fight, fight with all the strength one has, to make one's dream a reality. And this strength is knowledge, energy and will-power."

"I understand, Papa."

And in 1953 after passing from the Moscow secondary school No. 212, Vladislav Volkov joined the Ordzhonikidze Aviation Institute, the same from which his father had graduated.

The years of study did not dampen his desire to learn to fly. And for this the famous test pilot Sergei Anokhin, a person of exceptional valor and dedication to aviation, must be thanked. Volkov joined an aeroclub at his recommendation, successfully completed the course and received the certificate of pilot-sportsman. And although the document only gave him the right to fly in piston machines yet this was already a step towards the realization of the cherished dream—of becoming a test pilot.

The institute was over... In front lay the work to his chosen profession... And Vladislav Volkov moved to the design bureau, where models of new outer space technology were born, and passed along the path towards the goal of test pilot. The young engineer participated in the creation of various systems of space apparatus. "I was happy that a small part of my labor was put in the 'Vostok', in which Yurii Gagarin made the first flight into outer space", said Vladislav. During these years, Volkov met Konstantin Petrovich Feoktistov several times. It was Feoktistov's influence among the engineers that caused the talk about the importance of engineers', scientists' and specialists' flights into outer space to become more and more common.

Vladislav was present at the Baikonur cosmodrome for the first time in August 1962, when the "Vostok-3" and "Vostok-4" craft were launched into outer space one after the other. Engineer Volkov had participated in the technological preparation for the flight of the "Vostok" rocket-space system, created under S.P. Korolev's guidance.

"That was an amazing sight," Vladislav Nikolaevich recalled. "There you could have a distinct idea about the greatness of the vision which is first conceived on Whatman paper, and then gets its shape in metal. And although your own contribution may have been a very small one, all the same the heart is filled with pride, that you also have some connection with this great task, the conquest of nature."

The "Voskhod" craft went on an orbital flight two years after this event. K.P. Feoktistov was one of its crew. It became clear that the path for scientists into outer space was open. The idea of the creation of a group of engineers who could in future undertake outer space flights was born during those years.

The first meeting was held in the small study of Korolev. Naturally, everyone was very excited. Sergei Pavlovich also noted this. At first he got acquainted with each one of the engineers. They included Valerii Kubasov. He put a few questions to them. Volkov's turn came.

"Well, I already know you for a long time. You, I recollect, graduated from MAI?"

"Yes, in 1958."

"Which faculty did you complete?"

Volkov answered and at once added that the work of a tester of the new technology interested him very much.

"We all have collected here for this very purpose," observed the scientist. "Why else?"

After getting acquainted with everyone, Academician Korolev started speaking about the most important thing:

"A stage has come when engineers and specialists are needed on board the craft. People capable of analyzing the conditions of this or that system, of finding out their virtues and defects. It is unthinkable to perfect the craft and, in particular, work out their flight control system, and the system of return to earth without the participation of engineers."

Korolev drew with animation the plan of outer space conquest, of creation of orbital stations, of flight to the planets.

"Engineers and scientists from various branches of knowledge are the people who are destined to explore outer space, and put it into the service of the people of the earth."

A smile flitted across Sergei Pavlovich's face.

"We have faith in you, have pinned our hopes on you." Keeping quiet for a second, he added simply, almost dully: "And now start working!"

The engineers knew what was meant by "start working" according to Korolev's standard. It meant—not to spare oneself, to live first of all by the interests of the job, not to squander one's talents on trifles, but to take up the important problems and to tackle them earnestly, without turning this way or that. The young people continued to work inspired by the faith put in them and attracted by the dream... and waited... waited patiently for the magic words: "Are you ready?"

S.P. Korolev again called everyone to see him after a few months. This time he spoke the words they were waiting to hear. "It is time to start the direct preparation for the job." So their special training started.

Astronaut Volkov's diary has the following entry:

"August 25, 1966. When our group's turn came to work out the exit from the recovery capsule into water it had already started getting dark. We worked with spirit and everything went as it should. We didn't set a record, but we completed the task before the planned time. Only when we found ourselves in the sea and filled our lungs with fresh air we felt our blissful

tiredness. We fired a rocket flare. A scarlet cone of sparks shone above the dark surface of the sea..."

A year passed, then another. Vladislav Volkov had thoroughly studied space technology, and knew to the level of perfection how to use it. But still the State Commission did not nominate him as a member of the crew. It was not easy to wait...And although the load of work remained enormous, Vladislav Volkov remembered his childhood dream—he decided to learn to fly in jet aircraft. He successfully completed the special courses, and earned the right to pilot the fast moving MiGs together with an instructor.

"To fly jets is sheer enjoyment," Vladislav Volkov declared. "For this a person must know the machines extremely well and must have exceptional self-control together with quickness of reaction..."

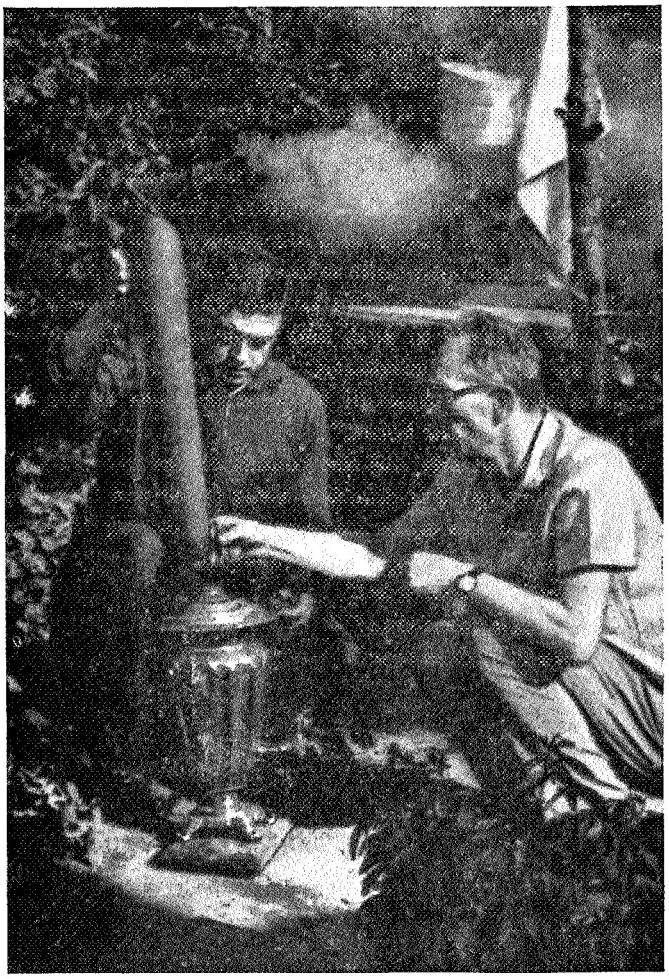
At last the long awaited day dawned. Vladislav Volkov was included in the crew of the "Soyuz-7" craft. Anatolii Filipchenko was the craft commander, Viktor Gorbatko, the Engineer-Explorer and he, Vladislav Volkov, the Flight Engineer. The way to the launching site continued for a number of years.

In Volkov's words, the flight engineer is the person who should be ready to carry out extremely accurate measurements of the parameters of relative movement of the craft and the measurements of the orbital parameters, who should fulfill a large volume of scientific-technological experiments and of course control the working of the systems on board.

The training for the working over of the flight program was very strenuous. But now that was also over. The tough examination commission had said "O.K.", and the State Commission, holding its session at the Baikonur cosmodrome, confirmed the preliminary decision about the membership of the crew. The start was scheduled for October 12.

According to tradition, on the eve of their "Soyuz–7" flight the crew came to the small wooden house protected from the steppe winds by young poplar trees. Sergei Pavlovich Korolev lived and worked here for a long time. All the three had met the Academician several times, had heard his talks about space technology, his advice and wishes for those who had already had the good fortune of assailing outer space. Today they had one more of their several talks with Korolev's successor, the Chief Designer of the "Soyuz" spacecraft. He said to the crew almost the same words which were usually pronounced by Sergei Pavlovich: "We have faith in you, we rely on you."

...The pilots quietly entered the house. A narrow corridor. On the left a small dining room. A round table, a few chairs. A couch covered with a carpet, a refrigerator. On the other side—the bedroom. A writing table, Lenin's portrait, a bed. Here the scientist spent his hours of rest. They were of short duration—he did not sleep for more than four hours in a day. And he



"A difficult problem..."

always took a book in his hand, maybe just for fifteen minutes. A small library, but how it characterized the owner of the books...

"Lenin and Science", Volkov read. "The Principles of Marxist Philosophy"... And where did Sergei Pavlovich find time to read all this?

"It was a necessity. Just like eating, drinking and breathing," observed Anatolii Filipchenko.

"Look here, a very rare book," Gorbatko opened the volume and started reading. "Kibal'chich, Tsander, Kondratyuk." The books of M.Y.

Lermontov and S.T. Aksakov, Mikhail Sholokhov and Aleksandr Kazantsev were also here. A photograph of the reverse side of the moon, taken by a space apparatus, created under the Academician's guidance...

Then they went to Yurii Gagarin's house—which was also as small as the one belonging to Academician Korolev. From here the first explorer Yurii Gagarin, and after him German Titov, Andriyan Nikolaev and Pavel Popovich, Valerii Bykovskii, Valentina Tereshkova—all had stepped up to the start. Now these two houses are memorial museums. A special hotel for the astronauts has been built at the end of a small park.

...Noon, October 12. The launch site has already been cleared. The huge rocket is ready to push into outer space. The crew of "Soyuz-7" is waiting for the final command.

Craft commander Anatolii Filipchenko looks at his watch.

"Thirteen forty-four hours."

A few more seconds and the launch rocket quivers a little as it is fired, then, gathering speed it thunders away faster and faster into space.

The hearts of the three astronauts beat during these moments joyfully as never before, tapping out in unison:

"A dream has come true!"

"A dream has come true!"

"A dream has come true!"

SON OF KUBAN'

WHEN astronaut Gorbatko met his friends after the flight, they asked him jokingly:

"Viktor, you must have searched for your native Kuban' from outer space?"

"Yes, of course. I saw my native territory and sent my regards to my fellow-countrymen."

Sometime afterwards the cities and villages of the Krasnodar region heartily and triumphantly welcomed the member of the "Soyuz-7" crew, Hero of the Soviet Union, Pilot-Astronaut of the USSR, Colonel Viktor Vasil'evich Gorbatko.

"I am very happy," said Viktor, "to visit Kuban' once again. My whole life is connected with this area. I thought about it at the time of the start as well as in outer space."

Viktor was born in the Ventsy-Zarya settlement of the Caucasus region, and spent his childhood, school years and YCL youth in the "Voskhod" horsefarm settlement in the Novokuban' region. It is natural that a visit

to these places was particularly exciting for the astronaut. Here lived people with whom he grew up.

On this day all the inhabitants of the Ventsy-Zarya settlement had come out into the streets. They had put on their Kuban' dresses as if it were a festival day. They welcomed Gorbatko with hand clappings and greetings. The Pioneers of the V.V. Gorbatko detachment presented him a photograph, in which the whole detachment had been photographed. Student Lyuda Sidorova dedicated touching verses to her fellow-countryman.

The "Gorbatko detachment" was very happy to receive the astronaut at their school, in that very school No. 30 where he had studied up to the seventh class. The hero embraced his first teacher Nadezhda Ivanovna Karaulova with tenderness.

A surprise awaited the Pioneers at their festival parade. Viktor Vasil'evich took from his pocket a badge with Lenin's picture on it, raised it for all to see and said:

"I took this badge with me on the outer space flight. Now I present it to you with all my heart."

On this day the festive spirit reigned in another school too, in School No. 2 of "Progress" settlement, for the future astronaut had studied there also. Viktor Vasil'evich came to his class, sat for a while behind his old desk and then planted a tree in the school garden. Viktor had left this place as a young man with his high school certificate, and now he had returned to the same place as a colonel and an astronaut.

The pilgrimage to the boyhood places continued. The Kuban' astronaut was awaited impatiently by the inhabitants of Sovetskaya Stanitsa, where the astronaut's younger sister Lyudmila worked as an agronomist in the collective farm "Lenin Legacy", with their mother Matrena Aleksandrovna.

Bread and salt was brought to Gorbatko in accordance with the local custom.

"This round loaf is baked," said the field team leader A. Kh. Kiselev, "from wheat, grown by our own farmers. Welcome to our collective farm!"

The village club didn't have enough space to accommodate all who wanted to attend the meeting.

Declaring the meeting open, the president of the agricultural association, Hero of Socialist Labor, M.Y. Gromikov informed the audience that the management had decided to make Viktor Vasil'evich an honorary collective farmer.

When Gorbatko was given the labor work-book and a scarlet band with the words "Honorary Collective Farmer of Lenin's Legacy Kolkhoz" was tied across his shoulder, a stormy applause rung out.

The astronaut remembered the words of Valentina Burtseva, manager of the dairy farm:

"We are happy to hear that you had tasty and nourishing food in outer

space. It is possible that it was prepared from products produced by the Kuban' cattle breeders."

The pilot-astronaut also applauded the words of student Tonya Shuklina:

"Viktor Vasil'evich, your heroic feat serves as an example for us. Many of the boys and girls dream about flights to other planets. And we are confident that this dream will come true, because we live in the country of the Soviets..."

The beloved guest was told how they had rejoiced at the Stanitsa, when they came to know that he had flown into outer space. Scores of people came to congratulate Matrena Aleksandrovna, bringing flowers with them. The daughters Elena, Valentina, Lyudmila and son Boris were with their mother that day.

The mother knew that her son was a pilot-astronaut and had visited him in the "Star City" several times, waiting for his cherished dream to come true. And on the day she saw the launching on television she was excited to hear Viktor's words before the start.

The family decided to send a telegram to Viktor and his comrades Anatolii Filipchenko and Vladislav Volkov. It brought great happiness to the members of the crew.

...While in his native place Viktor recalled the difficult childhood years, the war and the period of Nazi occupation. He learned to study from an ABC book, which the Gestapo had censored. Anything about the Soviet Union, such as pictures which could remind the boys of their Soviet heritage, had been torn out. But the teacher, Nadezhda Ivanovna Karaulova, taught the boys about Lenin, the Soviet motherland, the Soviet Army, about Moscow and the Red Square...

Some terrible memories of the occupation remained, like the shooting of a Soviet officer. The threat of being shot hung over his Young Communist Leaguer sisters Lena and Valya also. The Nazis had already put them on the list, but our people arrived first. The happiness of being free from the Nazi yoke was boundless.

...Before flying into outer space Gorbatko told the journalists:

"It is difficult for me to explain at present as to who or what, in fact, aroused in me the desire to become a pilot. In any case there was no particular push. I remember with what ecstasy we, the village boys, watched our aircraft shooting up the German cavalry.

"A wounded brother returned from near Stalingrad and described how our fighter planes had fought there very bravely. My sister married a pilot. I remember his stories. I even remember his dress: after the war it was very bad with regard to clothes in the village and I used to put on his old uniform."

At the recruiting station Viktor requested that he be sent for aviation. He joined the school for the preliminary training of pilots. Lieutenant Baskakov was Viktor's instructor here. Here also Gorbatko met another

future astronaut, Evgenii Khrunov.

Aviation not only trained Gorbatko, but also matured him. The Bataisk Military College was specially useful for him. The young man wrote home during those years. "We have become real pilots and have started flying in reality—in jets! Tomorrow again flying. We get up early... I am happy that I came here. Our instructor—Captain Filatov—is an excellent pilot and a likeable person. It is true that he has a peculiar characteristic. On the ground courteous, wouldn't even pronounce the word 'devil', but as soon as you take off he starts cursing. When you land, you think: now he'll cut me to pieces, but no, he starts discussing the flight calmly..."

The unit to which Gorbatko and Khrunov were posted after college had a glorious fighting history. The friends greedily absorbed the stories about their unit's feats of gallantry and learnt bravery, decisiveness and resourcefulness from their comrades.

When the pilot was asked if he had to face any special crisis in the sky during those years, he answered:

"I did not have any unusual events, any special episode—when one has to risk one's life. Everything went on very smoothly in a routine way, not at all the way I used to imagine from behind a school desk. And everything was so difficult exactly because of the sheer repetitiveness from day to day."

Even so, we came to know that once Gorbatko had to come out of a difficult situation within a few critical minutes. The weather was really bad. But the flight went on strictly according to program. Suddenly the instruments failed. At the same time the fuel was running out. The red lamp was flickering dangerously, warning that the condition was precarious.

The pilot proved not only his ability, but his bravery, resourcefulness and strong will-power also. The aircraft landed safely. Those who were at the airport highly praised the pilot's skill.

The year 1960 was marked in Gorbatko's life by his joining the astronauts' detachment. He started the special training aimed at the stars, together with Gagarin and the other pilots.

This is how his instructor Yurii Romanov, who watched him over the course of several years, characterized Viktor Vasil'evich.

"Engineer-Explorer Viktor Gorbatko gained much experience in the astronauts' detachment. Comprehensive analyses of the results of each manned craft and generalization from the materials of research and experiment helped him in the successful preparation for his own outer space mission."

Gorbatko took his work with exceptional responsibility. Hence he continuously put questions to the specialists, comrades and instructors. At times these questions were put not so much with the aim of finding out the answer, as for confirming the correctness of his own knowledge.

Craft kept on going into outer space while Gorbatko continued his training

The crew of "Soyuz-7" in the aircraft-laboratory.

and studies. His knowledge and experience were highly valued at the time of deciding the doubles for the crew of "Voskhod-2". He and Khrunov were selected. Together with Aleksei Leonov the friends trained themselves for exit into open space.

"At first everything went well," says Viktor, "then suddenly the doctors found in me some undesirable changes in the electro-cardiogram. I was confined to hospital for one and a half months. Some people said my 'space career' had come to an end. But the matter was set right: my tonsils were removed and in the cardiogram everything came back to normal.

"I passed through the medical commission once again and was asked to continue training. But I landed awkwardly at the time of a parachute jump and a crack appeared in the bone near the ankle. It was my own fault. By this time I had already jumped about 120 times. I was over-confident. Quite honestly I was afraid, for at that very time the crews for the three new spacecraft were just being recruited. I was very much afraid that I would get the sack, but as you see..."

Viktor was named the double of Evgenii Khrunov who was a member of

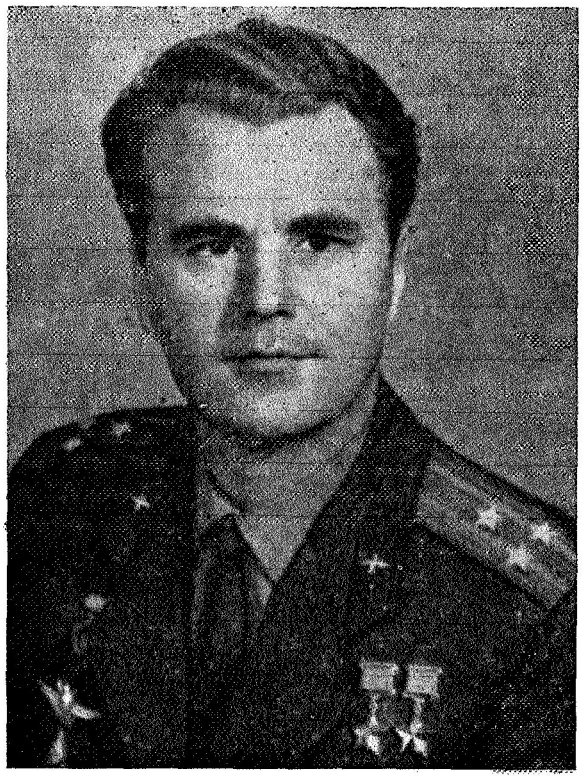
the "Soyuz–5" crew. The distinctive motto of Gorbatko: "A pilot-astronaut must be true to his aim both at the time of success as well as failure" had been justified.

With the help of his physical tempering he was able to win the title of detachment champion in tennis, to become in Aleksei Leonov's expression, the sports' pride of the "Star City".

By taking part in the group flight of three "Soyuz" craft, dedicated to the Lenin centenary, Gorbatko demonstrated his high qualifications as an engineer-astronaut. We are not speaking at this stage about his qualities as a man, since flying as a member of the crew called for special virtues in each one of them.

"Our crew," describes Viktor Vasil'evich, "consisted of three people and special attention was paid to it. But earth is earth. Complete compatibility in all its aspects can be checked only during the flight. But now after the completion of the mission I can say that we had really achieved compatibility. And even if there were some small differences at the start of the flight, we worked very harmoniously towards the end of the mission and our friendship grew in proportion to the number of hours spent in outer space.

"Everything at the time of the flight seemed so interesting, important and attractive that we tried to plan our time as carefully as possible. And we worked, worked and worked. The volume of research was quite big. It is sad that much of the valuable apparatus had to be left in the orbital compartment. But, of course, the most valuable and interesting was brought back by us to the earth for further testing."

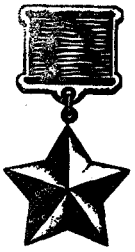


Vladimir Aleksandrovich Shatalov,
Twice Hero of the Soviet Union.

TASS ANNOUNCEMENT

On October 13, 1969 in accordance with the general program of manned flights, the Soviet spacecraft "Soyuz-8" went into orbit around the earth.

The spacecraft is manned by a crew consisting of the commander, Pilot-Astronaut of the USSR, Colonel Vladimir Aleksandrovich Shatalov, Hero of the Soviet Union and Flight Engineer, Pilot-Astronaut of the USSR, Aleksei Stanislavovich Eliseev, Hero of the Soviet Union, who had participated in the "Soyuz-4" and "Soyuz-5" flights.



"Soyuz-8"

For successfully carrying out a group flight in the "Soyuz-6", "Soyuz-7" and "Soyuz-8" spacecraft and for displaying bravery and heroism, the commander of the "Soyuz-8" spacecraft Pilot-Astronaut of the USSR, Vladimir Aleksandrovich Shatalov, Hero of the Soviet Union, is awarded a second Gold Star Medal.

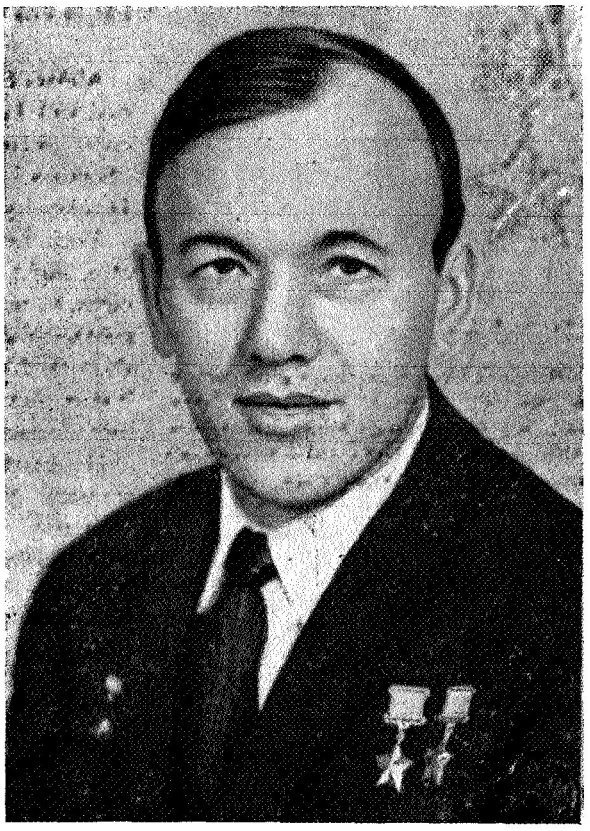
* * *

FROM THE HERO'S LIFE

Astronaut Vladimir Aleksandrovich Shatalov's name is already well known. He carried out an orbital flight in the "Soyuz-4" spacecraft between January 14-17, 1969. Together with the crew of the "Soyuz-5" craft he took part in the setting up of the world's first experimental space station.

During the group flight of the "Soyuz-6", "Soyuz-7" and "Soyuz-8" craft, V.A. Shatalov was not only the commander of the "Soyuz-8" craft, but also the leader of the outer space squadron.

1961—1971



Aleksei Stanislavovich Eliseev,
Twice Hero of the Soviet Union.

TASS ANNOUNCEMENT

The flight of a group of three Soviet spacecraft with seven astronauts on board is a new achievement of our science and technology.

An important step has been taken in the development of orbital flights and utilization of manned outer space systems for solving national economic and scientific problems.

"Soyuz-8"

For successfully carrying out a group flight of the "Soyuz-6", "Soyuz-7" and "Soyuz-8" spacecraft and for displaying bravery and heroism, Pilot-Astronaut of the USSR Aleksei Stanislavovich Eliseev, Hero of the Soviet Union, is awarded a second Gold Star Medal.

* * *

FROM THE HERO'S LIFE

Aleksei Stanislavovich Eliseev carried out his first orbital flight as a crew member of the spacecraft "Soyuz-5" and "Soyuz-4" between January 15-17, 1969.

Then he had fulfilled the duties of a flight engineer and also participated in taking observations of geological-geographical objects on the earth's surface, of heavenly bodies and carried out navigational measurements.

He carried out the world's first transfer via open space from "Soyuz-5" to "Soyuz-4" together with engineer-research worker E.V. Khrunov. The astronauts fulfilled a number of assembly and dismantling works during this transfer.

THE LENIN SHIFT

"I REPORT to the Central Committee of the Communist Party of the Soviet Union, to the Presidium of the Supreme Soviet of the USSR, to the Council of Ministers of the USSR."

These words had resounded for the first time at Vnukovo Airport when Vladimir Shatalov returned from his flight in the "Soyuz-4" and now for the second time when the group of seven brave men successfully completed the prolonged group flight in outer space.

Colonel Shatalov and his comrades went along the traditional carpeted path from the aircraft ladder to the Government rostrum excited and happy. The report was made. The commander of the spacecraft group reported:

"The task set by the motherland to carry out an outer space flight in the craft "Soyuz-6", "Soyuz-7" and "Soyuz-8" has been completed.

"For the first time in history a group outer space flight by three craft in a near-earth orbit has been successfully carried out.

"Their instruments and apparatus worked normally. The crew members feel well. They are ready to take on new tasks set by the motherland."

...And a few days earlier we had heard Vladimir Shatalov's farewell report at the cosmodrome on the readiness of the crew of the three craft to carry out in outer space a number of important scientific-technological experiments.

At that time the commander stressed: "We dedicate this flight to the Lenin Centenary."

The group of Soviet explorers, led by Shatalov, went up into outer space thinking about Lenin, with Lenin in their hearts.

Our astronauts are of one bone and one flesh with the Soviet nation. For them Lenin's name is sacred, as it is sacred for every one of the Soviet people. To visit the Lenin mausoleum before a flight into outer space has become a tradition.

Once Astronaut–1 Yurii Gagarin said that the Leninist thought about the boundless possibilities of human reason when properly applied, always urged him forward, and never allowed him to become stagnant or take a rest...

"My father studied all his life," German Titov said. "He fostered in me respect for his generation, and his generation did a lot: it established a first class socialist industry in the country, organized collective farms, smashed Nazi Germany.

"Once I asked my father: 'When you were young, where did you get the strength to overcome every difficulty and go forward in life?' My father replied: 'Lenin gave us the call to enrich our minds from the treasury of knowledge which is the common heritage of mankind. This was said for all time to come, for all generations'. 'Following Lenin's legacy', continued father, 'I studied and I shall no doubt spend a lot more time studying'."

Astronaut–2 remembers with excitement how he went to the Red Square together with his wife just before the flight.

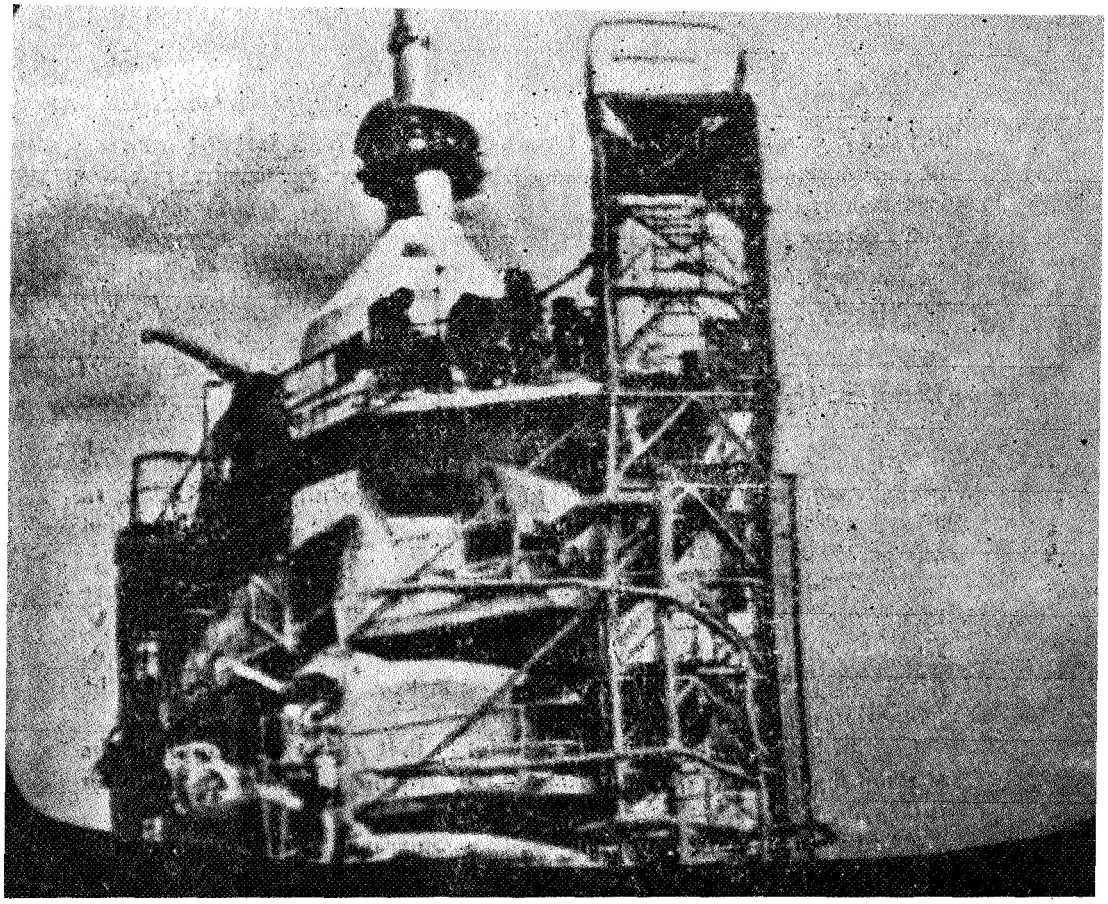
"We came up to the Lenin mausoleum quietly. Lenin! This name had inspired the revolutionary workers and peasants to assault the Czarist autocracy. The Soviet people went to fight the enemies of the motherland with Lenin's name and they won in his name. The same Soviet people had put up the launching site from where our mighty rockets soared up to the stars..."

At the Red Square Andriyan Nikolaev and Pavel Popovich took an oath before Lenin. When the astronauts came to the mausoleum, Nikolaev said to his friend: "Let us swear by Lenin and in the name of his party..."

Valya Tereshkova with Valerii Bykovskii also came to honor Lenin.

When Moscow triumphantly welcomed Bykovskii and Tereshkova, the excited Valya expressed her feelings thus:

"I looked at the animated, seething stream of spectators and the fluttering flags and thought: how can I thank you my dear people ? There is only one way of doing this—by following the advice of Lenin and serving the motherland."



The spacecraft "Soyuz-7", as seen on television.

On October 19, 1964 the commander of the "Voskhod", Vladimir Komarov, reported on his flight, addressing a meeting from the heights of the mausoleum rostrum. He told how songs glorifying Lenin, the Communist party and the Soviet people, had come through to him at that enormous distance in space. This had bound the crew to their native land with invisible strings of happiness.

At a reception in the Kremlin, a hearty meeting between the crew of "Voskhod-2" and party and Government leaders took place near the historic picture "Lenin's speech at the third Congress of the Young Communist League". It seemed as if the great Lenin was all the time present invisibly in the hall. The members of the "Voskhod" crew had taken with them a portrait of Lenin into outer space. The heroes of outer space attribute their success to the Leninist party.

Pavel Belyaev said: "The Soviet people came to their present leading position in science and technology because the great party of the immortal Lenin

led and continues to lead them. I am happy beyond bounds that I am a son of the glorious Leninist party and became a direct participant in space conquest on its orders."

So believe all the astronauts. In his turn Vladimir Shatalov announced to the whole country, to the whole world from the rostrum of the Kremlin Palace of Congresses:

"There is no higher happiness than to feel oneself a son of the great Soviet family of peoples, building communism, the great movement of Lenin—standard bearer of the most progressive ideas of modern times.

"All the crew participating in the 'Soyuz' flights are communist. We are all members of the glorious Communist Party of the Soviet Union. In all our affairs the image of our dear Lenin, the image of he who founded our party, is held in our hearts."

...According to custom, the communists of the "Star City" bade goodbye to the seven friends before they left for the cosmodrome. G. Shonin, V. Kubasov, A. Filipchenko, V. Volkov, V. Gorbatko, V. Shatalov and A. Eliseev said that they would make every effort to fulfill the tasks set by the motherland.

Georgii Shonin said, "We are very lucky that we have to continue the series of flights in the present memorable year—the year of preparation for the Lenin Centenary."

"And we shall carry out the flight in a manner befitting the communist!", added Valerii Kubasov.

The spacecraft bade goodbye to the earth. First to start was "Soyuz-6". Next to appear in outer space was "Soyuz-7". And when "Soyuz-8" was launched, the whole world started following the group flight with bated breath.

As always TASS information gave news of the progress of the experiment, and the condition of the astronauts. The radio and press carried the news to millions of people all over the earth in many languages.

"According to Pilot-Astronaut Shatalov's report, the astronauts are feeling fine."

"Reliable radio communication has been established between the crew of the three craft."

For the first time a group flight of three manned craft, with seven people on board was taking place in a near-earth orbit.

After completing the program the three "Soyuz" craft landed in turn in the predetermined area. When the leader of the group, Vladimir Shatalov, was asked to share his impressions about his second flight into outer space, he said:

"One may talk for a long time about space flight. Many very interesting moments have stuck in the memory. But during the present flight the most

interesting moment, the most impressive thing was the meeting of craft in outer space.

"When you have waited very much for something and at last it happens, then extreme happiness overtakes you. So it was with the meeting of our spacecraft. You must understand this is a very difficult and highly complex process. Sometimes at a command from the earth the craft meet, but more often one has to determine oneself the necessary data, so that one may meet comrade-astronauts at a predetermined time and at a predetermined point. Every time the maneuver calculations were found exact and the craft approached one another, our happiness knew no bounds.

"In the old days people searched for Australia or India, for months they roamed about in the high seas and suddenly the outline of an unknown shore would appear on the horizon. The travellers would be in raptures. Similarly we would gaze into the distance, searching for our craft in the shoreless vasts of outer space. A meeting above the planet leaves an unforgettable impression.

"Yes, during the flight we had to dock and delink several times: this was part of the job."

As commander of the group of spacecraft, Vladimir highly appreciated the activities of the two supporting crew:

"I must say that the crew were very well trained and every one worked accurately, confidently. When we solved the complex problems of the flight program together, all the operations were carried out quickly, calmly and confidently. If it were not so, we couldn't have docked so exactly, because the slightest deviation would have had immediate effect on the general standard of the crew's work."

And this is how the Chief Designer of the "Soyuz" characterized the activities of Shatalov:

"For the first time a specially appointed commander—Colonel Vladimir Shatalov—guided a group of craft at definite stages in outer space. He coordinated the efforts of all the crew, carrying out a number of predetermined scientific-technological tasks. As a result, it was shown that a wide group of scientific-technological problems connected primarily with the implementation of outer space technology, could be successfully tackled together at the same time."

The Chief Designer stressed that the astronauts were required to have very wide knowledge, excellent professional preparedness, and perfect understanding of the materials of their craft. And they had handled their job well.

"We the scientists," he said, "are proud of them and are happy that the efforts of the many collectives which participated in the preparation and performance of the experiments, have culminated in success."

The flight of the "Star Squadron" opened a new page in the exploration of the universe.

A long time back, Karl Marx called the members of the Paris Commune people who assaulted the sky. At the time of the revolutionary struggle in Russia, Lenin wrote: "The working class of Russia has already proved once, and will prove again several times over, that it is capable of 'assaulting the sky'."

In our day the Soviet people are assaulting the sky in a meaningful way for they are conquering outer space.

"TO FLY CONTINUOUSLY..."

In the Moscow outskirts, a bit to one side of the highway which carries fast traffic from Vnukovo to the capital, there are new blocks of flats. In one of these lives Aleksei Eliseev, Twice Hero of the Soviet Union, with his family.

The host—a tall, round-headed person with big gray eyes—opened the door. We had seen Aleksei from such close quarters only once before, in June 1969 in the "Star City", on the day of the American astronaut Frank Borman's visit. Eliseev stood away from the rest, engrossed in thought. It seemed that he didn't even notice that we took his photograph although the distance was only a meter.

"Come in," the astronaut invites. A small study with nothing extra in it. A writing table, easy chair, sofa, bookcase... And perhaps only the suitcases, stuffed in between the bookcase and the wall, speak about Eliseev's journeying profession. Catching our glance, Aleksei Stanislavovich observed:

"Everything is packed, just like a soldier. Depending on orders, I take the small one for short tours and the more spacious one to the cosmodrome."

"Aren't you tired after the second flight?"

"Tired? No. I consider the astronaut to be a test pilot. According to me, the work of a test pilot-astronaut can be considered to have been completed only when the particular type of flying apparatus goes into serial production. On the basis of my personal experience, in October 1969 at the time of my second journey into outer space I was convinced of the importance of being a professional test pilot-astronaut.

"A repeat flight helps better to adapt oneself to life under unusual circumstances. Also the experience of working with the craft systems at the time of various experiments is consolidated.

"Although I knew how the automatic system of the craft worked, I could not control it as accurately when I flew the first time, as I could on the second flight. During the second mission I could even apprehend by sound whether the automatic machines followed the command or not. Everything went on normally. I didn't notice a lot of things at the time of the first flight : all my attention was concentrated in carrying out the planned scientific experiments. Every member of the crew had to undertake purely technological responsibilities as well as research ones. For instance, I was flight engineer; my main responsibility was to control the working of the lifesaving systems, temperature control systems or those systems which function at the time of the craft's maneuvering. But during the rest of the time I carried out purely scientific research. For doing everything well, one has to learn to work accurately in weightlessness, to accustom oneself to look in the needed direction, to watch that part of the earth which is required to be observed, to select the most interesting feature, say the cloud formation if one is working for the meteorological section.

"I consider that an astronaut must fly continuously, must fly till the doctors say 'Enough'."

"What do the scientists think in this regard?"

"You will agree that if the scientists entrusted us—myself and Vladimir Shatalov—with a second flight into outer space, it means that it is not just my point of view. Just a minute."

The astronaut opened the writing table drawer, took out a newspaper cutting and passed it to us. This was a conversation with the Chief Designer of the "Soyuz" published in the "Komsomol'skaya Pravda". It summed up the flight of three craft around the earth together.

The designer said during this conversation:

"I want once again to stress the importance of the preparedness of the astronauts for the flight. If you remember, at first the pilots who flew into outer space had not in general undergone a very prolonged 'outer space' training. Later, scientists and engineers also started flying. This was not caprice but necessity. Just as on the ground, people must accumulate experience, must master their professions fully. This is why repeated sojourns by experienced

astronauts in missions of various scientific assignments are useful.

"The conquest of outer space is not a short duration campaign. This is a historically inevitable step by humanity, of broadening the knowledge of the world surrounding ourselves and the utilization of its riches in the interest of human beings".

"You must have met the Chief Designer of the 'Soyuz' several times?"

"A number of times, but not so very often. He is a very busy person. He entrusted his child—the spacecraft—to us. The scientist knows everyone taking part in the flights well. Every meeting with him is very useful. I particularly remember the talk with him before the first flight. It seemed as if we were talking about some routine job, which in fact had already been finished and in outer space we had only to carry out the concluding stages accurately. The Chief Designer had no doubts about the success of the mission. He told us how the craft and the launch rocket were being made ready for the flight during the final hours before the launch. He asked if we had any questions. In concluding his remarks, he wished us a good rest before the mission, successful completion of the program and readiness for new, even more interesting experiments. After every meeting with the Chief Designer new problems and new ideas took shape in our minds. The scientist during the conversation sowed the seeds of new ideas in us imperceptibly. And one felt like working still better, deploying all one's strength and knowledge to this great task.

"We know how much and how strenuously the Chief Designer worked, how the magnificent collective of designers, scientists, engineers and workers led by him also worked. And we the astronauts wished them all success, more than anyone else..."

The conversation took a turn towards the special features of the group flight of "Soyuz-6", "Soyuz-7" and "Soyuz-8" and about the role of man in spacecraft.

The astronaut leant back in his chair and spoke deliberately:

"It is known to everyone that automatic machines play a big role in modern life and, naturally, in space technology too. A great majority of processes in spacecraft have been automatized. The flying apparatus is put in the orbit with the help of automatic machines. They maintain a determined temperature and composition of atmosphere in the cabin of the craft. They also control the working of the main engine, transmit telemetric information about the working and parameters of the systems to the earth. The computing machines on board the craft determine the trajectory of the craft and several other things. Finally the automatic instruments ensure the craft's landing on earth.

"At present a lot is said about manual control and about its ever wider utilization in spacecraft. But at the base of any control lies the work of a larger or smaller number of automatic systems. The astronaut prepares

the predetermined regime for them, switches on the needed instruments, carries out, for example, the orientation or stabilization by moving the control handle and thus giving a command for the firing of the corresponding engines. Every action of the astronaut is a command to the automatic devices. The astronaut takes navigational measurements, supplies the data to the machines for calculations, takes decisions about the corrections in the flight trajectory. The man always remains the boss of the automatic machines and their guide."

...On our host's table there were books by the aviation-designer A.S. Yakovlev, and two bulky volumes of "Technological Cybernetics" by Marshal of the Soviet Union, G.K. Zhukov. With our host's permission we open one of the volumes. It is full of formulas and...more formulas. Some of them occupy half the page, while others the full page. We, of course, don't understand a thing.

"Well, how do you like it?", laughs Aleksei Stanislavovich. "Technological progress is taking place at such a rate that it's difficult to keep pace. It is a pity that there is hardly any time to read fiction." Picking up one of the volumes he continued, "Here, the theory of automatic regulation has been explained, applied to practical problems."

"Is everything written here applicable only to spacecraft?"

"No, automatic regulation is being used very much in the most varied technological installations. And speaking about the craft, it also in the last analysis is a complex system of automatic regulation.

"When we got ready for the experiment, we had constant contact with the builders of the 'Soyuz'. We knew which questions interested them more and which less. It is well known that a given assembly or a whole system exists at first in several versions. When you fly, you remember all this and, naturally, you try to evaluate how correct this or that decision was.

"When you return from the flight, you again meet the people working these things out and acquaint them with your remarks and suggestions. Before the flight a huge list of questions about the systems of the craft is put before you, still more questions are asked of us after our return. We have to answer all these questions in detail. By this we cooperate in perfecting the spacecraft. As a rule we test a number of instruments necessary for craft of new design during the flight. The designers take note of our recommendation, for what they are worth. This is why I am for the compulsory presence of the appropriate specialist on board the craft. He must continue the work started on the earth.

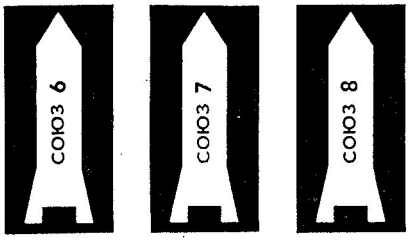
"I have already said that the spacecraft consists of a whole complex of intricate systems of the most varied assignments. The crew, and the flight engineer in particular, must constantly follow the working of all these systems and anticipate the possible defects. For this the instruments must be inspected regularly, they should be retuned and regulated if possible. And if some

defect has crept in, he should be capable of removing it quickly. At the same time it may so happen that the time available for taking the decision may be only a few seconds.

"The craft crew, on a distant flight, has willynilly to shoulder functions about the analysis of working and preventive inspection of systems on board which, for example, in aviation are carried out by the highly qualified ground servicing engineering-technical personnel. Hence the astronauts must have wide practical knowledge in the fields of electronics, electric-technology, mechanics, etc."

"Your work is not so easy!"

"That's why it's so interesting!"



THE RESEARCH PROGRAM

A group flight of manned spacecraft "Soyuz-6", "Soyuz-7" and "Soyuz-8" took place on October 11–18, 1969. A wide range of scientific-technological problems were placed by the State Commission before the participants of the experiment.

The construction and the systems on board the improved "Soyuz" spacecraft were to be tested; the systems of manual control, orientation and stabilization in orbit had to be worked out further, the means and methods of independent navigation had to be tested. It was also required that mutual maneuvering of the craft in orbit should be carried out by using the data of independent navigational measurements and utilizing the manual controls. This was essential for working out manned space systems.

For the first time the working out of a method of simultaneous control of three craft was aimed at. The astronauts had to test for the first time various means for the welding of metals in the outer space vacuum and in weightless conditions.

The program of scientific research was unusually extensive. It included

observation and photographing of certain regions of Soviet Union territory, including those parts which had been studied well in a geological-geographical sense, as well as obtaining spectra of forest masses, deserts, surface of lakes, seas and oceans, of fields covered with ice or snow, steppe, etc.

At the request of meteorologists the astronauts were to observe and take photographs of typhoons, cyclones, cloud formations, snow and ice fields. They had to collect data about the structure of the atmosphere, and reveal its optical heterogeneity, etc. The research of layers of brightness and other optical heterogeneities of the atmosphere had great importance for outer space navigation. The accuracy of orientation of the spacecraft relative to the earth depends on how reliably the boundary of the planet can be fixed, and this is determined by its optical qualities.

The astronauts were asked to carry out astrophysical observations and experiments such as the determination of polarization of solar rays reflected by the atmosphere, measurement of illumination created by the sun, determination of the real brightness of stars and so on.

The medico-biological program of the mission included: control of the rate of breathing and loss of energy at the working time under weightlessness; measuring of blood pressure and pulse rate; study of the effect of various rates of physical load on blood pressure, study of the influence of weightlessness on the vestibular apparatus; collection of data about the conditions of the psycho-physical functions of the human organism, etc.

Three crew were assembled for carrying out the new outer space experiment.

The launch rocket with "Soyuz-6" took off on October 11, 1969 at 1410 hours. On board were pilot-astronauts G. Shonin and V. Kubasov. The craft went into orbit as a satellite of the earth at 1419 hours.

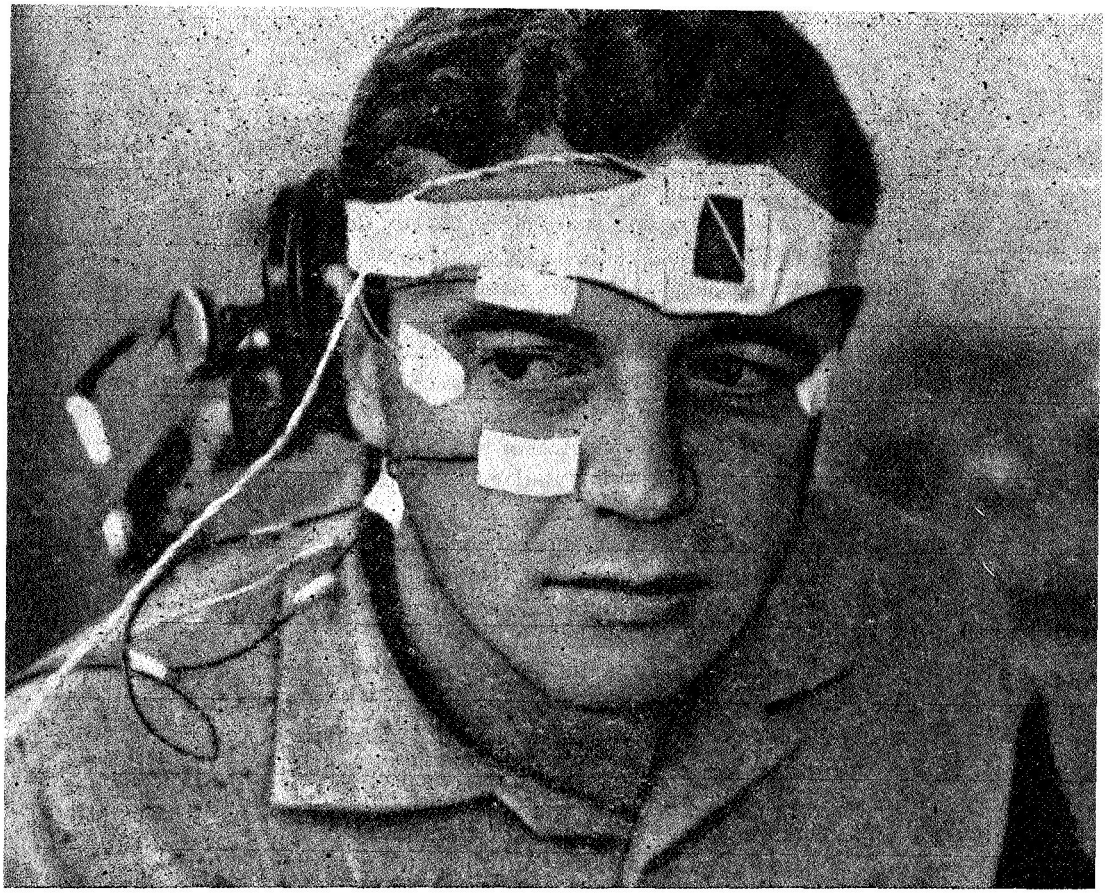
"Soyuz-7" with pilot-astronauts A. Filipchenko, V. Volkov and V. Gorbatko set out next day at 1345 hours.

On October 13, "Soyuz-8" was launched at 1319 hours. It joined orbit as a satellite of the earth at 1329 hours. V. Shatalov and A. Eliseev were on board.

After joining the orbit, the crew of "Soyuz-8" established communications with the crew of "Soyuz-6" and "Soyuz-7". The group flight of three spacecraft had started. The commander of "Soyuz-8" assumed his duties as the commander of the group flight.

OUTER SPACE SQUADRON IN ORBIT

On the first day of the joint voyage the crew of "Soyuz-6" carried out medico-biological research. The astronauts of "Soyuz-7" observed and took photographs of heavenly bodies, the horizon on the darker and illuminated sides of the earth in various ranges of the visible spectrum wavelengths. The



V.N. Volkov under medical observation.

polarization of solar light reflected by the atmosphere was studied with the help of instruments on "Soyuz-8".

On October 14 the crew simultaneously carried out joint experiments at various points in near-earth outer space. In particular, the astronauts on "Soyuz-6" and "Soyuz-8" observed and took photographs of cloud formations and cyclones, moon and stars in the background of the horizon, they also evaluated the brightness of our planet on the darker and illuminated sides. The commander of "Soyuz-8" carried out a number of maneuvers utilizing the manual controls. The crew of "Soyuz-7" oriented the craft manually for carrying out a number of experiments, which included taking photographs of regions of the Caspian Sea and worked out the elements of outer space navigation.

Continuing the medico-biological research, the astronauts studied the influence of outer space flight factors on the human organism. Analysis of medical information, data of radio conversations as well as observations

made by television testified to the fact that the astronauts maintained high efficiency.

On this day also the crew of all the three craft tested the working of the automatic and manual control systems. They determined the possibility of orienting the craft at dusk and in the shadow of the earth with the help of the optical visor, and controlled the accuracy of the system of manual orientation.

Besides this, "Soyuz-7" and "Soyuz-8" approached one another during the day. The possibility of exchanging information with the help of light indices and visual optical means was tested. This data was needed for the creation of long-duration orbital stations.

Tracking stations on the earth, situated in Soviet Union territory as well as the scientific-research ships of the USSR Academy of Science, "Kosmonavt Vladimir Komarov", "Morzhovets", "Nevel", "Bezhitsa", "Dolinsk", "Ristna", "Kegostrov" and "Borovichi" continuously received and processed the information being sent from the spacecraft and maintained permanent radio communications with the astronauts.

On October 15 the new working day for the group of astronauts started at 0530 hours Moscow time. They observed different parts of the earth's surface in the hilly regions during the early morning hours, they followed the spread of cloud and vertical formations over the Pacific and Atlantic Oceans, explored the reflective capacity of the forest masses and desert regions. During the second twenty-four hours of joint flight, the commanders of the spacecraft carried out maneuvering with manual controls.

Scientific and medical experiments continued on "Soyuz-6".

The crew of "Soyuz-7" controlled the systems on board, observed the luminous particles, tested the working of orientation systems and movement control, took photographs of the starry sky in the direction opposite the sun.

The astronauts of "Soyuz-8" kept track of the maneuverings of "Soyuz-7", studied the visual efficiency of the operator, and using special instruments, studied solar radiation.

On completing the first half of the working day, the crew maneuvered the craft with the help of manual controls and navigational systems on board. "Soyuz-7" and "Soyuz-8" approached each other to a distance of 500 meters. The astronauts kept track of one another through the portholes and maintained communication by using light signals. The panels of solar batteries, antennas and other elements of the craft's design could be clearly distinguished.

The approach of "Soyuz-7" and "Soyuz-8" and their mutual positions were observed and registered by the crew of "Soyuz-6". Within the framework of the program of physical research, experiments for determining the composition of the flow of cosmic rays were carried out; the processes taking place in the upper layers of earth's ionosphere were also studied.

During the second half of the day the astronauts worked out the methods

of measuring the parameters of the atmosphere and studied the processes taking place in it. They transmitted to the earth meteorological information about the condition of cloud covers, the formation of cyclones, the condition of snow coverings in the hilly regions of the Soviet Union.

On this very day various maneuverings in orbit took place, in which "Soyuz-6" and "Soyuz-8" approached "Soyuz-7" by turns. All these operations of craft coming near to one another were carried out by manual control.

The "Soyuz" craft flew in orbits near one another. The average of the orbit's parameters was: period of completing a circuit—88.6 minutes, apogee—225 kilometers, perigee—200 kilometers, inclination—51.7 degrees.

THE WELDING OF METALS IN OUTER SPACE

On the morning of October 16 the mission crew checked the condition of systems on board, and then started the scientific-technological and medico-biological experiments. The astronauts of "Soyuz-6" craft G. Shonin and V. Kubasov carried out welding operations. The orbital compartment of "Soyuz-6" had been equipped with the "Vulkan" device weighing 50 kilograms. With its help automatic welding could be carried out by three different methods: with the help of a compressed arc (low temperature plasma), electric ray and melting electrode. The control panel of the "Vulkan" device was in the astronauts' cabin.

Before starting welding, G. Shonin closed the exit-porthole of the craft's cabin and during the 77th circuit depressurized the orbital compartment. After some time V. Kubasov switched on the welding apparatus and carried out welding in an absolute vacuum by the three methods in turn: thin sheets of stainless steel and titanium were welded. The astronaut also cut stainless steel, titanium and aluminum, and worked with non-metallic materials. The behavior of drops of liquid metal and welding paste under conditions of weightlessness was studied.

After the experiment was completed, the orbital compartment was again pressurized and filled with artificial atmosphere. The astronauts went over to the compartment, where Kubasov imitated the manual operations for welding. Shonin was taking films all this time. This experiment was necessary for elucidating the most rational actions at the time of welding manually in weightlessness. The flight-engineer brought the samples of welding over to the cabin.

The experiments proved that the welding of metals by melting them is fully possible under conditions of weightlessness and vacuum in outer space. The data received testified to the correctness of the principal decisions taken in outer space and creating the instruments for it.

* * *

An important experiment—communication between a spacecraft and mission control via scientific-research ship and the satellite "Molniya-1"—was carried out on October 18 during the 79th circuit, at a time when "Soyuz-8" was outside the zone of Soviet radio visibility. The information from the mission control was transmitted into the "Orbit" system and then to "Molniya-1". From there the information was sent to the crew of the craft via the ship "Kosmonavt Vladimir Komarov", which was in the Atlantic Ocean. The experiment was successful. The two-way radio connection worked steadily, the time of communications with the spacecraft was considerably increased. This was very important for the flight of Soviet spacecraft, since they are out of the zone of radio visibility for a long time while moving in near-earth orbits and have no connection with the command-measurement points situated in USSR territory.

After completion of the experiments, the spacecraft left their orbits and landed in Kazakhstan in the Karaganda region: "Soyuz-6"—on October 16, at 1252 hours; "Soyuz-7"—on October 17, at 1226 hours; and "Soyuz-8"—on October 18, at 1210 hours. The first craft had stayed for 118 hours 42 minutes in outer space, the second for 118 hours 41 minutes and the third for 118 hours 51 minutes.

The results of the flights of "Soyuz-6", "Soyuz-7" and "Soyuz-8" have had great importance for the further development of space technology. Their experience will be used for the development of flights by manned spacecraft, for the construction of orbital stations, for the purpose of scientific research and the development of national economy.

Andriyan Grigor'evich Nikolaev,
Twice Hero of the Soviet Union.

TASS ANNOUNCEMENT

In the Soviet Union on June 1, 1970 at 2200 hours Moscow time, a launch rocket with the spacecraft "Soyuz-9" was fired into an orbit of the earth.

The spacecraft was manned by a crew consisting of the commander, Pilot-Astronaut of the USSR, Colonel Andriyan Grigor'evich Nikolaev, Hero of the Soviet Union and Flight-Engineer, Vitalii Ivanovich Sevast'yanov, Kandidat of Technological Sciences.

"Soyuz-9"

For successfully making a prolonged orbital flight in the "Soyuz-9" spacecraft and showing bravery and heroism Pilot-Astronaut of the USSR, Andriyan Grigor'evich Nikolaev, Hero of the Soviet Union, is awarded a second Gold Star Medal.

FROM THE HERO'S LIFE

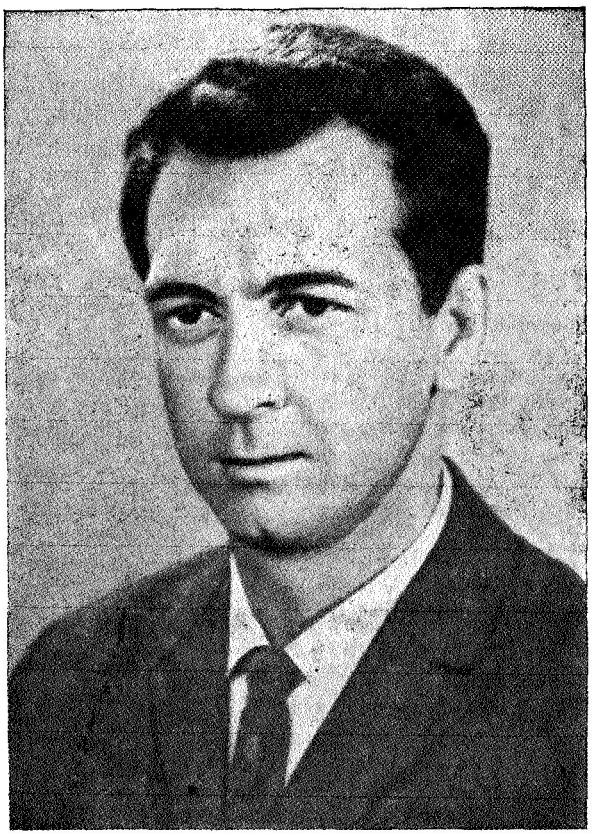
Pilot-Astronaut Andriyan Grigor'evich Nikolaev carried out a flight in the spacecraft "Vostok-3" in 1962.

After the flight, the Hero of the Soviet Union took an active part in the training of astronauts and prepared himself for another flight in the following years.

He graduated from the N.E. Zhukovskii Air Force Engineering Academy in 1968.

Andriyan Grigor'evich carries on a lot of social-political work, being a deputy of the Supreme Soviet of RSFSR.

After completion of the "Soyuz-9" flight, Colonel A.G. Nikolaev was promoted to the rank of Air Force Major-General.



Vitalii Ivanovich Sevast'yanov,
Hero of the Soviet Union.

TASS ANNOUNCEMENT

The crew of the spacecraft "Soyuz-9" stayed in orbital flight around the earth for 424 hours. For the first time under conditions of space flight man continued active work for such a length of time.

"Soyuz-9"

For successfully making a prolonged orbital flight in the "Soyuz-9" spacecraft and showing bravery and heroism, the title of the Hero of the Soviet Union with the award of the Order of Lenin and Gold Star Medal is conferred upon pilot-astronaut Vitalii Ivanovich Sevast'yanov.

* * *

For making a space flight in the "Soyuz-9" spacecraft the title of the "Pilot-Astronaut of the USSR" is conferred upon Vitalii Ivanovich Sevast'yanov, a citizen of the Soviet Union.

FROM THE HERO'S LIFE

Vitalii Ivanovich Sevast'yanov was born on June 8, 1935 in Krasnoural'sk city, Severdlov region. He spent his childhood and youth in Sochi.

After completing secondary school, he joined the Moscow Aviation Institute in 1953 and graduated in 1959. After that he started working in the designs bureau.

He was research scholar at MAI. He has the degree of Kandidat of Technological Sciences.

In 1963 V.I. Sevast'yanov joined the ranks of the Communist Party of the Soviet Union.

The engineer went through the complete training program for space flight in the astronauts' detachment.

"KNOWLEDGE, AND AGAIN MORE KNOWLEDGE"

For a long time Andriyan Grigor'evich Nikolaev was the commander of the astronauts' detachment. At present he is one of the leaders of the training center for astronauts. We knew him in those early days when he was still German Titov's double and preparing himself to become the commander of the "Vostok-3". We had met and talked with him a number of times over the years, all valuable, but one specially so. The morning of August 11, 1962 at the Baikonur cosmodrome was sunny. Andriyan Grigor'evich was standing on the platform near the rocket in full outer space dress. His soft voice could be heard:

"Dear comrades! My friends!

"Only recently I saw off my friends, astronauts Yurii Gagarin and German Titov on the first sorties to the stars, and now today I have the great honor of carrying out a new flight into outer space...

"From the bottom of my heart I thank the Leninist Central Committee and the Soviet Government for this trust. I shall use all my powers and knowledge for worthily fulfilling this honorable task..."

...For four days (a record-breaking time for that period), Nikolaev lived and worked in orbit around the earth, tested technology and checked the influence of the unusual conditions of outer space on his own person. Much water has flowed under the bridge since then. Andriyan Grigor'evich was one of the first among the astronauts to successfully graduate from the N.E. Zhukovskii Air Force Engineering Academy. But the dream about a new flight did not leave the astronaut. Once he told the journalists in light vein:

"My only job is to see off friends into outer space. But I would like to go myself."

In June 1969 an international conference of communist and workers parties was being held in Moscow. On a particular day a delegation of the Bulgarian Communist Party headed by Comrade Todor Zhivkov was awaited in the "Star City".

The scientists, specialists and heroes of outer space had collected at the entrance to the town near the building, where the astronaut-deputies usually received their constituents.

We stood near Nikolaev and talked to him about the training of astronauts. Everyone remembers Andriyan Nikolaev's first mission; how many days the flight continued; the importance of the group flight, in which Pavel Popovich also participated.

But not very much is known about how "Astronaut-3" and his friends prepared themselves for the start.

We requested Andriyan Grigor'evich to tell us in detail the preflight preparation of the astronauts.

"Where to start?" for a second his thick, dark brows closed over the bridge of the nose, forming a continuous line, then they parted slowly. "Some people have the impression that the most important thing in our astronaut preparation is physical training. Of course, the specialists have devised a complex of measures, which help in raising the steadiness of the organism to face such factors as the heavy gravitational pressure at the time of take off and return to the earth, and weightlessness. Much attention was paid to physical exercises."

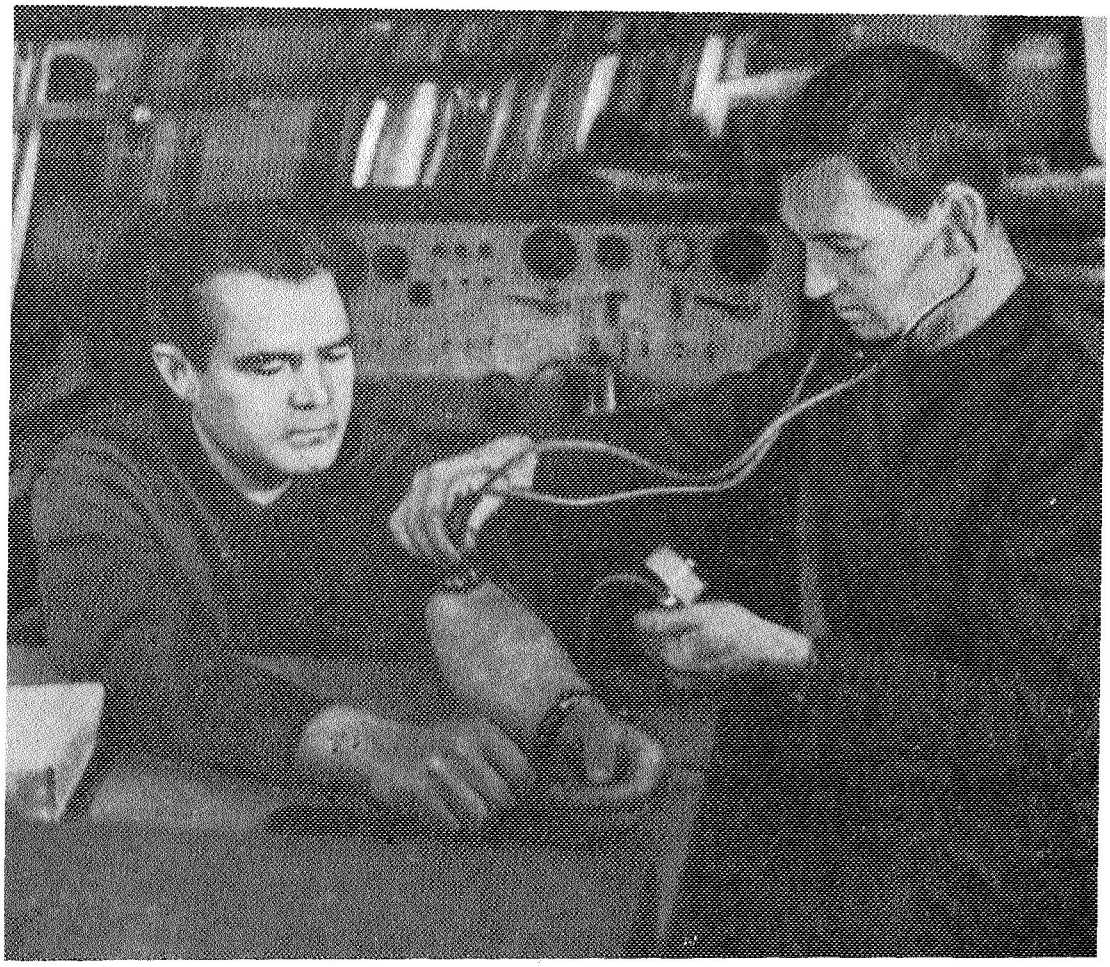
The Bulgarian friends arrived and Nikolaev hurried to them, saying on the move:

"The rest later!"

We set out for the laboratory of "Star City" together with the delegation of the Bulgarian Communist Party and the astronauts.

Andriyan Grigor'evich led the guests from one laboratory to another, describing how essential was the knowledge of technology to the astronaut.

"It may so happen that the commander has to take full control of the craft in his own hands," explained Nikolaev to the guests. "And the same happened when Pavel Belyaev, the commander of 'Voskhod-2', was forced to land the craft on earth himself. The possibilities of controlling manually have been



Medical self control.

considerably widened during the later flights, especially in the 'Soyuz' craft."

"Please tell us how the astronauts are prepared for the space flights", asked one of the guests.

"I should speak about three courses of training. In short they are: theoretical, medical and special. Everyone without exception studies space technology—the carrier rocket with its engines, the craft and its systems. One cannot be an astronaut without knowing sky mechanics, the astronomy and physics of the upper layers of the atmosphere and outer space. One cannot get away from the knowledge of navigation, meteorology, calculating techniques, even geology and much more. There is not a person among us, who does not know deeply the works of Tsiolkovskii, and his followers Tsander and Kondratyuk; the ideas and elaborations of Korolev and other scientists in the field of astronautics, plus the works of foreign specialists.

"Perhaps it is worth the trouble to explain in detail the special training. Everyone, who has dedicated himself to outer space has to pilot aircraft, jump with parachute, master radio-techniques, study the use of movie and still cameras, etc. This is compulsory for all. It is interesting to remember that German Titov, for example, over all the years as pilot and astronaut, sat in the cabins of various types of aircraft in all about 800 times."

"As the time of an outer space experiment draws near," continued A.G. Nikolaev "a group is selected from among the astronauts. From the group the main and doubling members of the crew of the craft are formed. Aleksei Leonov, for example, had two doubles—Evgenii Khrunov and Viktor Gorbatko..."

The Bulgarian comrades and journalists listened to the astronaut's story very attentively. General Nikolai Petrovich Kamanin, who is always sober in his evaluations, observed:

"This is what an engineering qualification means. The Zhukovskii Academy is a great thing," and added after a pause, "At present Nikolaev is undergoing constant training. He is getting ready for a flight."

"For a flight?"

"Let's listen to what he is saying," the General suggested.

"The time given to the preparation for an experiment increases in proportion to its complexity," narrated Andriyan Grigor'evich. "The craft is studied with complete thoroughness, specially if it is of a new type. The flight program, that is, all that the crew is supposed to carry out during the outer space voyage, is worked out a number of times. Sometimes one has to study seriously to master new professions. Let us suppose that the scientists decided to test the feasibility of electric welding under conditions of vacuum. This is very important for assembly jobs in outer space, and later for production on earth too. This means the astronaut has to master the profession of electric welder. Scientists of the most varied specialities entrust us with the carrying out of experiments and research in outer space. And we have to study all the time."

"Please tell us, Andriyan Grigor'evich, to what extent the preparation for the start has been brought closer to the real conditions of the flight?"

"Everything possible is worked out at the training place. But it is impossible to create a high vacuum or prolonged weightlessness on the earth. All the same, special trainer aircraft, spacecraft trainers and other devices allow us to carry on training with maximum effect."

Colonel Nikolaev drew the guests' attention to one of the craft. It was "earthly", and not destined to leave our planet.

"This is a composite trainer. It is a very complex and clever engineering device. In it the astronaut learns to control the craft, to exploit its equipment, to rehearse the coming outer space sortie from the launching till the return. The trainer is a copy of the craft's cabin or the so-called recovery capsule,

with all the systems and instruments. The guides of the training 'flight' can introduce 'defects' in the instruments and create a condition of 'emergency'. And then the astronaut gets the opportunity to test his knowledge, his mastery. The specialists also get assurances about how far their trainee is ready for the start."

The Bulgarian friends left the following note in the "Star City" visitors' book:

"Which man will not bow his head before the dedicated labors and heroic feats of the glorious space comrades, first explorers of outer space—the Soviet astronauts. All glory to the conquerors of outer space!..."

The capacity of quickly and firmly mastering new technology is a feature of Astronaut–3. Not everyone knows that he participated in the construction of the "Soyuz" craft along with other pilots.

...This happened during those days when the "Vostok" and "Voskhod" crafts were flying along in near-earth orbits. The spacecraft designers' thoughts were rushing ahead. Life itself demanded this.

Once Sergei Pavlovich Korolev invited a group of astronauts to see him at one of the experimental enterprises. He invited their opinion about the working out of the final version of the craft. And thus Yurii Gagarin, Andriyan Nikolaev, Evgenii Khrunov, Valerii Bykovskii, Georgii Shonin, Viktor Gorbatko and other pilots came to visit the creators of the spacecraft. As soon as they crossed the threshold of the workshop, the astronauts saw a full-scale model of the new craft. It astonished them by its size.

"Well, this is some machine!" shouted Yurii Gagarin, not hiding his happiness. "Two 'Vostoks'!"

Evgenii Aleksandrovich, the leading designer of the craft came out of the porthole. He supervises the craft from the working drawing to the seating of the astronauts in the cabin. Evgenii Aleksandrovich saw off everyone who flew in "Vostok" and "Voskhod". He was always there to close the hatch of the entrance porthole before the start and say: "Till we meet on earth!"

"Good day, Zhenya," resounded a chorus of voices in the workshop.

"Glad to see you," the specialist laughed as he answered.

"Sergei Pavlovich asked us to come..."

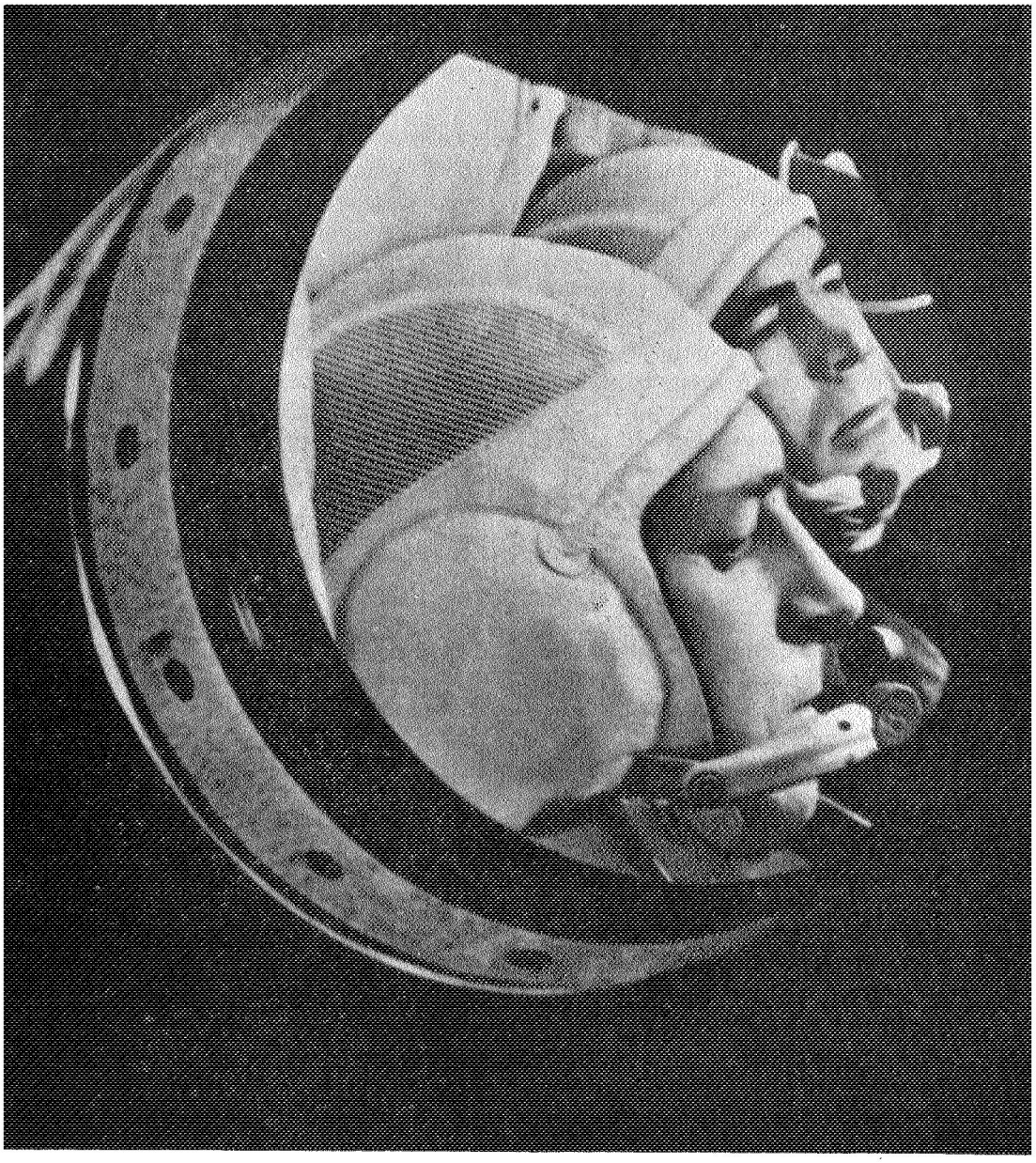
"I know! He will be here later. But for the time being have a look around," the engineer pointed towards the craft.

He didn't have to ask again. The astronauts immediately advanced towards the new craft. They had heard about it from the Academician, but didn't think it could be built so quickly. Another moment—and Yurii Gagarin, and behind him Andriyan Nikolaev, were in the craft.

Evgenii Aleksandrovich remained near the craft, watching the astronauts' pleasure.

"Tell us about the craft", asked Gagarin, when the pilots sat in the cabin.

"And not hurriedly, but everything in order", added Nikolaev, "we must



"Soyuz-9" crew in flight.

understand once and for all."

"Unlike 'Vostok' aud 'Voskhod', the new craft as you can see, is considerably more spacious," began the designer. "Look at this part—it is the orbital compartment. One can rest in it."

"Outer space saloon," smiled Nikolaev.

"Not just that. It is easy to carry out various scientific experiments in it. The passage from one compartment to the other can be hermetically sealed."

"It means that it is possible to go out into open space from this compartment after putting on a spacesuit," Evgenii Khrunov said animatedly. "That is comfort."

"And how will such a big bulky thing return to the earth?" asked Bykovskii. "What are its aerodynamic qualities?"

"Don't hurry me," said Evgenii Aleksandrovich. "So, as you see, the craft consists of three compartments—two for living and working, and one, as in the earlier models, for instruments and engines. At the end of the experiment—two of these will be thrown away. The recovery capsule has good aerodynamic qualities. Its utilization at the time of change over to the descent orbit has great importance: the high gravity pressure is reduced several times over, more accurate landing in the predetermined region is ensured."

Sergei Pavlovich, who had appeared unnoticed, threw a glance at the pilots and then started looking at Evgenii Aleksandrovich. He liked this young, knowledgeable engineer, who loved his work and could work for days on end. The scientist liked him for his ability to understand what he, Sergei Pavlovich, was thinking and for the fact that he was also persevering and accurate in his work. Even now listening to the engineer describing the new craft with confidence, with animation, the thought came to him: "Engineers and scientists should be prepared for the flights, people like —Zhenya". Then another thought came: "Who among these pilots will be testing the new craft? Maybe Gagarin: he has been asking a lot to be sent into outer space. Maybe Nikolaev. Or Khrunov—excellent double for Leonov?"

The pilots noticed Sergei Pavlovich and turned to him. The scientist threw a glance at the young friends.

"Well, how do you like it?" he asked, showing the model of the craft.

"Very spacious, we have already seen what's what..." answered Andriyan Nikolaev.

"Do you have any observations to make?" the scientist queried.

"We must think. It's not so easy," answered Georgii Shonin.

"I agree."

Andriyan Nikolaev looked at the craft once again. Then a smile appeared at the corner of his mouth.

"But how soon will the craft start flying, Sergei Pavlovich?"

"A lot depends on you. We are building the craft together." And then added the words, known to every astronaut who had met the Academician:

"*You* have to fly, *you* have to test."

The conversation started becoming more and more concrete in character, which was always pleasing to the scientists. The astronauts were practical people. And the question "When?" spoke a lot: that the astronauts were

ready and willing to test the new machine. The astronauts' interest was very dear to the scientist. But he wanted that each one of them as a test pilot should be interested in technology. S.P. Korolev always advised the "eaglets" to study and get engineering education...

After answering the pilots' questions in detail, the Academician said:

"When you graduate from the Academy, you will no doubt recall your questions. I am sure then they will bring a smile to your face."

And seeing the surprised faces of his audience he added softly:

"The more complex the technology entrusted to you, the more diverse the flight program, and the greater demand on your knowledge. And conquest of outer space will require just this: knowledge, knowledge, and again, more knowledge."

"Yes, we must study," said Gagarin.

"We will acquire the necessary knowledge, Sergei Pavlovich," promised Nikolaev.

"That's good," the Academician summed up, "you want to study—it means you want to fly..."

Later the group of astronauts started the work of preparation for flight on the "Soyuz".

* * *

Some time before the eighteen-day flight we asked Nikolaev, what he could tell us about the forthcoming experiment.

"Among the astronauts, it is not customary to talk about the coming day. Let us stick to this good tradition. After the flight—if you please."

"Then, maybe you will say a few words about your flight-engineer, Vitalii Sevast'yanov."

"Don't you know him? That's a pity. I couldn't wish for a better companion. He is an engineer, and Kandidat of Technological Sciences. He knows the craft and all its systems excellently. We worked out the flight program thoroughly together for a long time."

"Before the first flight into outer space in 1962 your friends characterized you as a person of exceptional self-control, they said that your motto is: calmness and again more calmness."

"They had just discovered it," the astronaut smiled. "I can also get excited, like everyone else. Self-control by itself is not enough in our work. Knowledge of technology is the most important thing. In general a man without knowledge is a useless person. Of course, in difficult situations and they can always arise—cold bloodedness, self-control, keeping one's nerve, the ability not to get perplexed and to quickly take the right decision—all these are essential not superfluous qualities."

"In short, calmness and again more calmness."

"If you like," concluded Andriyan Nikolaev.

THE DEAREST THING

It was the third day after the completion of the "Soyuz-9" flight. The first and, unfortunately, very short meeting with the astronauts took place. It lasted for exactly one minute.

"How do you feel on the earth?"

"We are getting accustomed," answered Nikolaev smilingly.

Vitalii Sevast'yanov said that the crew was working on its flight report.

"A lot of time will be spent on this..."

Doctor Vladimir Alekseevich made a warning gesture. We waved our hands at the astronauts who were behind a glass partition: "See you soon."

During those days Andriyan and Vitalii were under strict medical control. The doctors observed how the human organism gets accustomed to the pressure on earth after a prolonged stay in weightlessness.

Some time passed. During one of the meetings we asked Sevast'yanov to tell us how the "Soyuz-9" crew bore weightlessness. No one before them had been on an outer space flight for such a long time.

"We bore it easily. The following example can serve as the best proof

of our mood. Once Andriyan swam out of the sleeping bag while still asleep and slept on the roof of the orbital compartment. It is true that it was difficult to sleep during the first twenty-four hours, the hands would shoot up. But later on I slept calmly, even when I swam out of the bag and soared in the cabin. The earthly sleeping position was preserved: the hands and feet turned a little bit and were a little parted. Our sleep was sound, with dreams usual for the earth."

Sevast'yanov narrated a funny event which took place just after landing. They had their first lunch on the earth. Suddenly the flight-engineer saw a fly on the ceiling. He tried to push himself away from the table, imagining that he would swim to the roof, as on the craft. His attempt caused friendly laughter among all the people present in the room. Sevast'yanov also laughed heartily.

...Even before the launching of "Soyuz-9" the "Star City" doctors had planned how the medical check up of the astronauts should be organized after their return from the prolonged flight. When Nikolaev and Sevast'yanov landed, they were put in a special apartment. The doctors irradiated it with quartz for a number of days beforehand, as they were afraid of infection. Light sports costumes, and all objects in general, which the astronauts had to use, were disinfected. Only three doctors, relieving one another on a round-the-clock watch, were allowed to go to the astronauts.

There were weighty reasons for the precautionary measures. The fact is that the astronauts' immunity to diseases, specially to influenza and tonsilitis, became weak after the flight. And although Sevast'yanov's tonsils had been removed, he was also not immune to infection.

"We give first-category importance to a thorough medical check up of the crew of 'Soyuz-9'," the Chief Designer of the "Soyuz" series stressed during those days. "The elaboration of the peculiarities of getting accustomed to the earthly conditions after prolonged weightlessness is essential to decide the duration of outer space flights in future."

A glass partition separated the astronauts from the members at the meeting with the State Commission, summing up the results of the flight. The questions and answers were relayed through loud speakers. The press conference in the "Star City", which was held after the concluding meeting of the State Commission, was also organized in this manner.

"This is already the sixth day after the flight that we have been resting," Vitalii Sevast'yanov said at the press conference. "All this time we have been engaged in work, we are working on the materials contained in the logbooks. We are restoring the details of various experiments with fresh impressions. On landing we made notes about the descent of the craft. We are similarly recording for the benefit of medicine. It is true that the doctors allow us to work for only a few hours each day. But we wish to give the specialists the results of the flight data at the earliest, so that by comparing our data with

that recorded on the earth they can formulate their conclusions."

The flight-engineer complained that for the time being contact with the specialists was restricted. Then he added: "We are not losing time. We are preparing a report to put before the scientists."

The astronauts had been faced with an enormous volume of work. Its completion depended on their selfless labor in outer space. Sometimes Nikolaev and Sevast'yanov worked for over sixteen hours a day.

The flight program included not only new tasks of national economic importance, but also the continuation of observations started by the crew of previous missions. The starry path of "Soyuz-9" was not called a working sortie without reason.

Every time we heard Vitalii Sevast'yanov, whether at a press conference, or a reception in the huge Kremlin Palace, we always noticed his power of observation, his capacity to assess the main factor, his steadiness of thought and clearness of formulation. As a man also he was a very attractive person—jolly, energetic, social. Nikolaev must have rejoiced when he was informed that Sevast'yanov would be his companion.

Andriyan Grigor'evich got acquainted with Sevast'yanov long ago, when the young engineer delivered a lecture course on the latest rocket technology to the Gagarin group. It was at this time that the Astronaut-1 presented a photograph to Vitalii with the inscription: "To Vitalii Sevast'yanov in memory of outer space flights and our work. With great respect, Gagarin. 26.5.63."

Nikolaev and Sevast'yanov were in outer space for 424 hours. If the problem of compatibility of characters was discussed in detail while forming the crew of the "Voskhod" for a sortie of some twenty-four hours, how much more was it discussed now.

Andriyan Nikolaev said that the psychological compatibility of the "Soyuz-9" crew was good:

"Together, we prepared for the flight while on the earth for quite a long time," he stressed. "We were old pals. We decided all the questions together, helped each other in our work both by word and deed. If one was engaged in an experiment, the other did not sit with his hands idle. It seemed to me that the difference in our character was a help. If Vitalii was as uncommunicative as me then we would have kept quiet the whole flight. But he is more talkative," joked the commander.

During one of the conversations, Vitalii Ivanovich said:

"I was lucky in my commander. As a man he impressed me very much, especially by his modesty. I wish everyone could carry the 'burden of glory' over the years as well as Andriyan. His health at the age of forty was excellent. And you know how much willpower is required to keep oneself fit as age increases."

The "Eagles" lived in harmony. "Eagle-1" was Nikolaev, "Eagle-2"—

Free moments...

Sevast'yanov. These were their call signs which the earth would receive.

...In flight mission control people knew all the time what the astronauts were doing: whether they were carrying out scientific programs or shaving with an electric shaver; whether they were doing physical exercise in their special elastic costumes (whose material incorporated special rubber elements, which helped in straining the muscles uniformly) or cleaning their "two-room flat" with a vacuum cleaner; whether they were heating their coffee and lunch, or lying down to sleep in their light, training outfits.

Vitalii Sevast'yanov often looked at our planet, sitting near the porthole. It seemed as if he was studying a geographical map, recognizing the contours of the mountains, rivers, seas and even different cities.

Once the sensors caused a flutter in the engineer's heart. At that moment Vitalii was examining his native city Sochi, where he spent his school years and where his father and mother lived. His six-year-old daughter had gone to visit her grandparents at this time...

During the long flight of "Soyuz-9" many people visited the small house set on the green wooded hillock, a familiar sight to the members of the astronauts' detachment. Here Andriyan Nikolaev's first flight had been celebrated some time previously. Vitalii's mother, Tat'yana Georgievna entertained the visitors with Siberian meat dumplings, while the father, Ivan Grigor'evich

supplied homemade grape wine.

And of course, those who came to the house of the Sevast'yanovs' heard with fascination the stories about the astronaut. Ivan Grigor'evich recollected:

"Vitalii grew up like everyone else. All the little boys were somehow similar. But, perhaps, he liked the studies more than the others. He simply longed for knowledge. His gradings were always excellent. Aptitude for mathematics appeared in my son very early. He was attracted by radio technology in school, he tinkered with things, designed. He read a lot, took up Young Communist League tasks and participated in sports."

The boy studied in the Sochi School No. 9, situated on Nizhne-Razdol'naya Street, from class five onwards. The school has been named after Nikolai Ostrovskii, and brings up the boys in the Korchagin traditions. Everyone who crosses its threshold is met by the words: "The most valuable thing a man has is life. It is given to him only once and it should be lived in such a way that he has no pangs of remorse at not having made the best use of his time."

Every student knows the path to the house-museum of N.A. Ostrovskii. How many times had Vitalii entered Nikolai Ostrovskii's house; always with emotion to hear again and again the stories about the courageous struggle with a serious illness carried on by this unusual person. And every time the schoolboy looked for a long time at the cardboard lining frame, with which the blind, bedridden writer worked, the words of Yulius Fuchik (on reading the novel "How the Steel was Tempered") stuck for ever to his memory: "Nothing is dreadful for a communist—this is what emerges from the book, this is the sum total of the author's life." Pavel Korchagin became an ideal, on whose pattern Vitalii based his life. The young man always strived towards his aim perseveringly and overcame his difficulties, both during the school and the college days, and also later in his designer's work.

"When Vitalii joined the Moscow Aviation Institute," the astronaut's father continued, "he started training at the aeroclub where he flew and made parachute jumps. At the same time he learnt a foreign language for two years by correspondence course. Vitalii worked as a guide and interpreter at the World Youth and Students' Festival, held in Moscow. When he was in the fourth course, the Academic Council awarded the Aviation-Designer Polikarpov Scholarship to my son for his scientific work. While still a student, Vitalii started delivering lectures. He graduated from the institute with honors. I will never forget the day when he defended his Kandidat's thesis. I received a telegram: "Defended successfully, all were in favor"—and I even started weeping with joy: a chauffeur, to have a son who is Kandidat of Sciences!"

Vitalii's institute comrades recollect how he became "infected" with the ideas of Tsiolkovskii, and tried to extirpate the formula about first and

second outer space velocities put forward by other scientists. In the fourth course a group of students started designing a rocket for launching an artificial satellite of the earth weighing 50 kilograms. Sevast'yanov's job was to lead the general designing and to make ballistic calculations.

The young people were utterly absorbed in the work, when the radio announced: "A Soviet artificial earth satellite weighing 83.6 kilograms is in orbit!" The future engineers again sat down to calculate, recalculate and draw. Then the dream of a 100 kilogram satellite became a reality, when the Soviet Union launched a satellite with the dog *Laika* weighing 508.3 kilograms.

The young researcher's labor showed what each of the creators of this "satellite" was capable of. In the testimonial given to Vitalii Sevast'yanov together with the Diploma of Aircraft Engineer-Mechanic it is stated: "He has an inclination for scientific work."

The work in the design bureau gave him valuable practical experience. A research scholarship in MAI, and defense of his Kandidat's thesis opened the way to scientific work.

Professor Yurii Aleksandrovich Pobedonostsev, Doctor of Technological Sciences, Honored Scientist and Technologist, helped Sevast' yanov in taking the first steps into the scientific field. It was he who paid attention to the article of a student, which appeared in the Institute's widely circulated "Propeller". The article was entitled "The recovery apparatus of the space crew on the path towards the earth". It was published on February 26, 1958 under the heading "Request for Diploma Project".

V. Sevast'yanov wrote:

"This article is dedicated to the problem of the return of spacecraft to the earth. At present, with the launching of the first artificial earth satellites by the Soviet Union, humanity is entering the era of outer space communications; the problem has ceased to be a hypothetical one and has become one of the vital practical problems facing the scientific world.

"The problem of the return of the passenger spacecraft is—figuratively speaking—the threshold, the crossing of which will lead straight into outer space."

It should be remembered that these lines were written three years before Yurii Gagarin's flight. Further on Sevast'yanov examined in detail the mechanism of descent of the winged recovery apparatus. He stressed that the shape of the apparatus is of very great importance. The recovery apparatus, according to Sevast'yanov's opinion, must have high lift and great frontal resistance. The frontal resistance is essential for reducing the speed, while the high lift helps in reducing the speed of descent (starting from very great heights), as a result of which the intensity of the aerodynamic heating of the sheathing is reduced.

"Who prompted these thoughts and conclusions?" Professor Y.A.

Pobedonostsev asked the student.

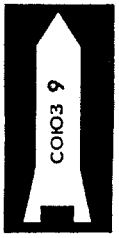
"I worked them out myself. I read a lot of Tsiolkovskii, Yatsunskii, Sveshnikov..."

"Well done! It is a very interesting article."

Later they had a number of discussions. Vitalii always listened very attentively to his teacher, who was one of the pioneers among Soviet rocket builders. Y.A. Pobedonostsev was a member of the group for studying jet propulsion, the so-called GIRD, which was led by S.P. Korolev. The idea of the practical utilization of jet engines in aviation matured in this collective. GIRD members considered that the construction of aircraft which would fly faster, higher and longer than others was essential. The first flight was carried out on February 28, 1940 by the pilot V.P. Fedorov, in a rocket plane designed by Sergei Pavlovich Korolev, with a jet engine working on nitric acid (as the oxidizer) and kerosene (as fuel). The first rocket-plane had all the basic elements of the jet aircraft...

Yurii Aleksandrovich Pobedonostsev became the guide and friendly adviser of Sevast'yanov in his later years. The most cordial relations were maintained between teacher and student.

First at the student's desk, then in the astronauts' detachment and finally on the outer space flight, Velerii Sevast'yanov studied the "earthly essence of outer space".



424 HOURS IN ORBIT AROUND THE EARTH

DURING the earlier flights of the "Soyuz" craft, the basic technological problems connected with the consideration of long duration orbital stations were solved.

Then the tasks of finding out the possibilities of a human being's prolonged stay in outer space and the capacity to work during an outer space sortie were set. The consistent accumulation of data about the protracted influence of weightlessness and other factors of space flight on the human organism was important for establishing long-duration orbital stations and for interplanetary sorties. It is important not to underestimate the value of the astronaut's presence on board the craft during the study of the globe's surface, atmosphere, and outer space medium.

For the regular outer space experiment—the 18-day flight of the "Soyuz-9" craft—the scientists had fixed the aim as the study of the influence of protracted action of the combined surrounding factors on the human organism and especially to test his capacity to work actively under conditions of weightlessness for a prolonged period. The study of the process of the astronauts'

reacclimatization to the condition of earth's gravity was also important.

The flight program of "Soyuz-9" included a wide complex of scientific-technological and medico-biological research and experiments. The working out of the manual and automatic systems of control, orientation and stabilization, the checkup of the independent means of navigation at different regimes of flight, as well as investigation of various elements of the craft's design—the movable mechanical units, portholes, etc. was also envisaged.

During the flight the astronauts had to observe the earth, using optical instruments, take photographs of geological-geographical objects with the aim of drawing geological maps and determine the possible regions of deposits of useful minerals, to observe and take photographs of atmospheric formations with the aim of operational and long-term meteorological prognosis, to explore the physical characteristics, phenomena and processes in near-earth outer space.

Medico-biological research was an important part of the flight program. The study of the adaptability of the human organism, the influence of weightlessness and lowered muscular activity on the processes of metabolism, the cardiovascular system, bone and joint system and the nature of blood circulation was also envisaged in these studies. The crew's capacity to work at various stages of the flight was also to be explored.

Under conditions of weightlessness the muscles do not experience great load and begin to grow weak. The human organism gets retuned and the course of biochemical and physiological processes in it changes. The bones become "soft", the pressure on the heart and the character of blood circulation changes, calcium goes out of the organism along with water and so on. In the last analysis, the reversible process can be harmful for man if it is not stopped. The astronauts had to carry out a series of physical exercises during the flight to neutralize to some extent the effect of weightlessness.

The spacecraft "Soyuz-9" was launched on June 1, 1970 at 2200 hours Moscow time from the Baikonur cosmodrome.

The commander of the craft was Andriyan Grigor'evich Nikolaev and the flight-engineer Vitalii Ivanovich Sevast'yanov, Kandidat of Technological Sciences. The craft was put into orbit as a satellite of the earth with the following parameters: apogee—220 kilometers, perigee—207 kilometers, orbital inclination—51.7 degrees, circuit time—88.59 minutes.

The astronauts oriented the craft in outer space with manual controls and tested the star sensor a number of times during the flight. In spite of strong light encumbrances, the sensor ensured reliable and accurate orientation of the craft. The tests of an optical-electronic device, created with the aim of orienting the craft with respect to the earth while flying on its darker side, also gave good results. Nikolaev and Sevast'yanov used the calculating devices on board to work out the means and methods of autonomous navigation.

A number of experiments were connected with the study of the characteristics of the craft's construction. The deformations in the construction, causing the conditions of vacuum and heating by the sun were measured; the working of precision mechanisms and optical units was studied; high accuracy portholes, ensuring the reliable working of optical devices, were tested, the effect of aerodynamic and gravitational moments on the dynamic characteristics and controllability of the craft were evaluated. During the prolonged outer space flight, the crew of "Soyuz-9" also carried out the checkup of various lifesaving systems.

Nikolaev and Sevast'yanov carried out experiments on the study of the functions of the vestibular apparatus, the dynamics of blood pressure, external breathing, the character of the skin's sensitiveness to pain, the contrast sensitivity of the eyes, the muscular strength of the hands and so on.

Calculations about the energy spent by the astronauts were also made during the flight. This was important for constructing the optimal systems of safeguarding life, as well as for working out a scientifically sound food ration and water intake.

Experiments of national economic importance were also planned. A complex experiment was carried out during the 188th circuit, when the craft was over the Indian Ocean. Besides the crew of "Soyuz-9", the "Meteor" satellite and scientific-research ship "Academician Shirshov" also took part. From the ship, radiosondes were launched to measure the temperature and wind velocities in the different layers of the atmosphere. The "Meteor" satellite flying at that very moment over the same territory, transmitted a series of television pictures from a height of about 630 kilometers, while Nikolaev and Sevast'yanov observed the region from a lower orbit. A similar experiment in which the crew of the "Soyuz-7" craft, aircraft and surface expeditions jointly participated, was carried out in October 1969. Such experiments have a great importance for meteorologists, since they permit a composite study of the atmospheric conditions over the land and oceans, and the structure of cloud coverings.

Photographs were taken simultaneously with the meteorological satellites over Africa, the Atlantic Ocean and the southern portion of the Indian Ocean. During the flight the astronauts also observed cyclones and fixed the regions of dust storms.

The scientific program included taking photographs of the earth's horizon and the moon on the background of the earth's horizon. The brightness of various objects in the visual region of the spectrum was also investigated during the flight. This experiment aimed at investigating the possibility of new systems of astronavigation. The astronauts carried out over 50 different experiments during the flight; moreover each one was repeated several times. As a result, rich statistical material was received.

Now a few words about how Nikolaev and Sevast'yanov felt during the

flight. They got used to the condition of weightlessness quickly. However, during the first two days the astronauts felt the influx of blood towards the head and were constrained on their movements. It took time to get used to making movements in weightlessness. The period of acclimatization came to an end during the third day of the flight, by which time an unusual lightness, accuracy and firmness in movement had appeared. There was even automation in going over from one compartment of the craft to the other.

The astronauts maintained the highest working capacity, in spite of the extensive flight program. Sleep took away some of the tiredness. The routine of labor and rest helped in maintaining their form. The astronauts performed specially worked out complexes of physical exercises twice every day for an hour at a time. During the 9th and 17th days of the flight they had "holidays", which were devoted to rest. The astronauts were provided natural products to eat and their appetite was good.

The lifesaving systems of "Soyuz-9" worked without any hitch. They maintained the predetermined conditions of gas composition, temperature, humidity and pressure of the atmosphere in the craft's compartments.

The "Soyuz-9" flight mission was successfully completed on June 19, 1970. Specialists and doctors met the astronauts with great warmth at the landing site.

As the scientists had expected, definite difficulties arose after the flight, connected with the acclimatization of the human organism to the conditions of life on earth. For Nikolaev and Sevast'yanov after their prolonged stay under conditions of weightlessness, it was difficult to get up from an easy chair. Comrades from the rescue group helped them to come out of the recovery capsule after the hatch was opened.

During the first few hours the astronauts preferred to stay in a lying condition. Even after 24 hours their gait was not firm. Nikolaev and Sevast'yanov observed that the head, limbs and other parts of the body seemed to be unusually heavy. This condition continued for about three days. Normalization of the organism's condition was completed by the 10th day on earth.

The "Soyuz-9" flight of Nikolaev and Sevast'yanov had great importance for the further development of astronautics. It proved convincingly that a man can live not only for a long time, but can also work effectively under the conditions of outer space flight.

A PEEP INTO THE FUTURE

THE FIRST SETTLEMENT IN OUTER SPACE

In the past dreamers and later on scientists planned to conquer outer space and even worked out in theory the idea of starting human settlements. Today the inhabitants of the earth are nearer the realization of these daring schemes than ever before.

Soviet scientists were the first to place an experimental station in the earth's orbit. The day is not far off when permanently manned space stations, first on a geocentric, then later on a selenocentric and eventually (in the more distant future) on a planetocentric orbit, will start flying.

Why is there so much talk about this? Simply because it is difficult to overestimate the importance of the station for the progress of science and technology. It is a fact that each one of them could replace tens, or even hundreds of artificial satellites used for meteorological research, geological exploration, communications, navigation, experiments in the field of geophysics, study of interplanetary medium and so on. Thanks to the practically

unlimited sizes of the stations, it would be possible to carry out on the station observations in various regions of the spectrum by utilizing huge astronomical devices, to make physical and chemical experiments under conditions of complete vacuum, to make use of the phenomena of super-conductivity at zero temperature and complete vacuum, for the preparation of super-pure materials and assembly of specially accurate details and elements of various systems. The carrying out of a wide range of experiments on animals and flora under conditions of weightlessness, with the possibility of the consequent utilization of the results of research for the treatment of some human diseases, is also a cause of enormous scientific interest. But what about the training of astronauts for prolonged space flights? Biological research, conducted in the orbital stations, would help the scientists to find out how a prolonged stay under outer space flight conditions affects the human being and how long he can endure weightlessness. It would become clear whether artificial pressure was required and its minimum essential magnitude for a human being.

Scientists consider that the systems for providing oxygen, food and water to the crew of interplanetary craft will be worked out in the orbital stations. The data about this is absolutely essential for planning and designing the craft for flights to the planets of the solar system.

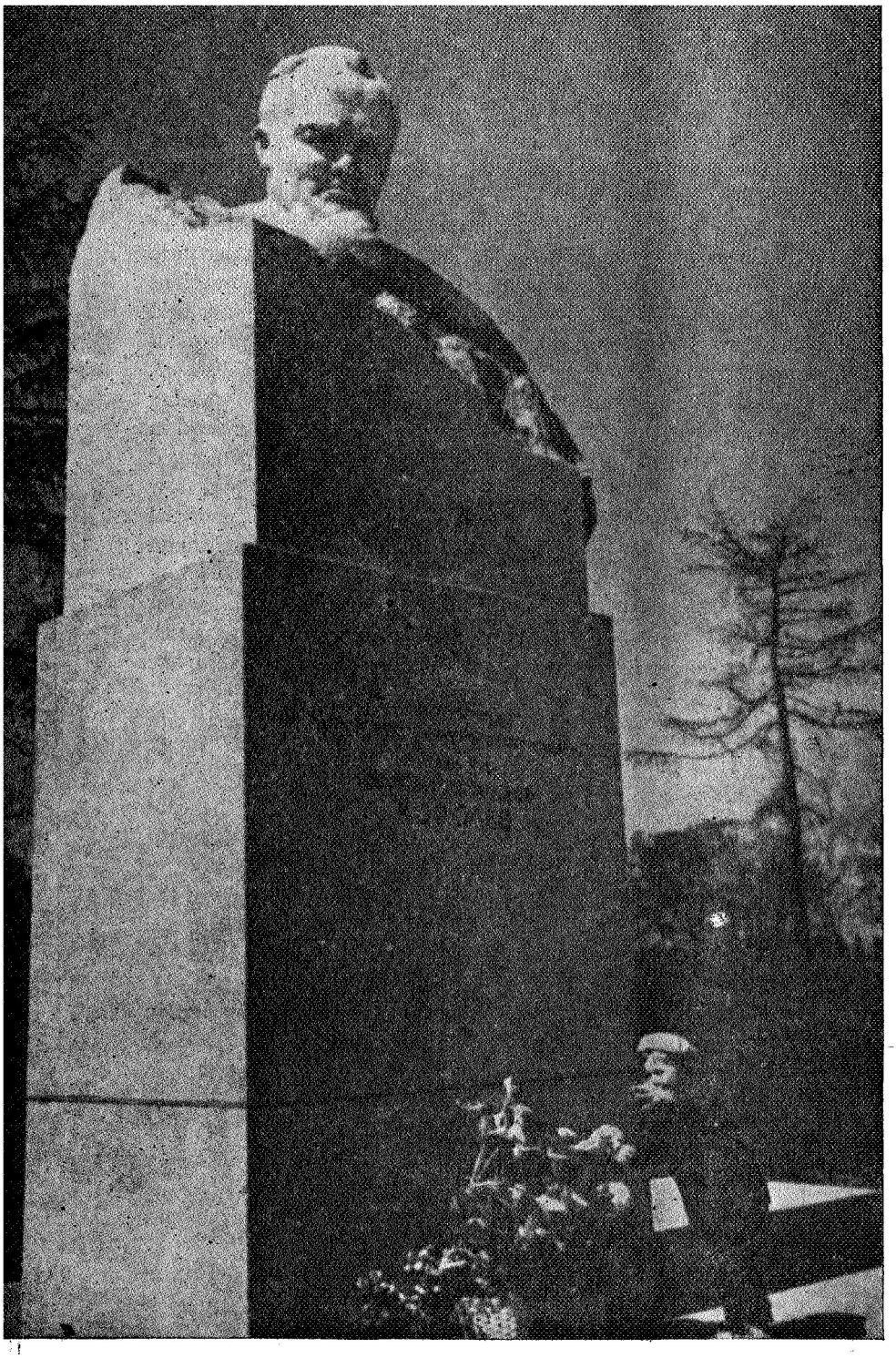
There is no doubt that the crew of outer space stations will consist not only of pilot-astronauts, but also of scientists and engineers who have specialized in the most varied branches of science and technology.

It seems impossible to make a big space station on the earth and then put it into orbit. The capacity of launch rockets is limited. Besides the weight limit put on the useful payload of the launch rockets, there is also a limit to the size. The useful payload should not be more than the main part of the rocket in size. Otherwise it would lead to excessive aerodynamic resistance at the time of passing the thick layers of atmosphere and to great aerodynamic side loads, which could simply destroy the rocket during the flight.

Thus everything speaks of the advisability of constructing the station in the orbit itself. Soviet Union outer space experiments have confirmed its feasibility. Let us see the building sequence of a manned space station in orbit around the earth.

Various factors are taken into consideration while determining the orbit. Thus the lower limit of the flight height is fixed depending on the necessary duration of the station's existence, taking into account the friction in the higher reaches of the atmosphere. While determining the maximum height, the radiation belt of the earth cannot be forgotten.

Round orbits make for easy maneuvering at the approach to the orbital station of outer space flying apparatus. The selection of the inclination of the station's orbit to the equator's plane depends entirely on the problems to be solved by it. For example, orbits passing through the north and south



Statue of S.P. Korolev.

poles of the earth are useful for geophysical and meteorological observations, and also as the intermediary launching sites for the flight of interplanetary craft.

First of all, the central block of the station with several docking units and transfer airlocks would likely be put into orbit, and the remaining blocks added to it. These blocks could be brought near and docked with the central unit either with the help of automatic systems, or by using manual control. Of course, docking mechanisms can be envisaged which would join the blocks without human involvement. However the joinings and additional assembly jobs should be undertaken by specialists who go out into open outer space to check the reliability of the whole construction. Besides it is simply impossible to assemble some of the elements of the station without the direct participation of man, e.g., the gigantic solar panels or radio telescope antennas.

In a word, we cannot do without man, or his work on board the craft. This is why the experiments for the astronauts' exit into free outer space, the performance of assembly jobs and the transfer from one craft to another are being thoroughly rehearsed.

It may be presumed that the contemporary spacecraft with slight changes will become the constituent elements of the first space stations. They can be adapted without special efforts as an apartment of the orbital station, since they have enough space. The docking units of the craft could be redesigned in such a way that a pressurized tunnel would be formed between the craft after linkup, for transfer from one craft to the other without going into open outer space. However, the device of auxiliary airlocks, which can be established in the orbit itself, may prove to be more useful. But it will require assembly work in outer space.

In any case, even if the station is assembled from special blocks, one or even several multiseater spacecraft will necessarily be included in the construction. This version of the station is convenient because in case of an accident the craft can quickly delink and either return to the earth independently, or change over to a safer orbit, waiting for help.

Let us suppose that the orbital scientific station has been established. Now the crew, food stocks, oxygen, scientific instruments, etc. have to be sent on board. In the later stages, the crew have to be periodically relieved, the stocks of food and the fuel for correcting the orbit of the station have to be replenished, new instruments have to be sent and so on. All this would necessitate the construction of a freight-passenger spacecraft. As and when necessary it would fly on the route "earth-spacestation-earth".

The method of approach and docking of these craft with the orbital station would probably differ little from that used in the "Soyuz" outer space experiments.

Probably the orbital station will rotate round its center of gravity. This will

help in creating artificial gravity for the members of the crew by the most economic method, with the help of centrifugal forces. The experiments with weightlessness can, however, be carried on in the central compartment of the station, where the influence of centrifugal forces will be almost absent.

The linkup of a craft with a rotating orbital station presents a very difficult problem. Either the spacecraft will have to be given rotation with the same angular velocity as the station or it will be necessary to set up at its center an immovable, nonrotating linkup block.

ON THE PATH TO THE PLANETS

The experience of approach and docking of crafts in orbit is extremely important for the assembly of large interplanetary craft for further flights into distant outer space. The considerations about the advisability of assembly in orbit of interplanetary craft are analogous to those put forward earlier in connection with the creation of orbital station. The assembly process of interplanetary craft will not differ to a great extent from the assembly of the station. Specially high demands must be made on the reliability of the craft assembled in orbit. The fact of the matter is, it will be almost impossible to take advantage of help from the earth for setting right any defect that may suddenly appear in the craft during its flight to the distant planet or on the journey homewards.

The spacecraft can be collected in orbit in free space. Another possible solution would be the creation of a permanent orbital cosmodrome, specially meant for the assembly and launching of interplanetary craft and their reception on return from their distant mission. Later on they will be established in the orbit of a moon satellite and then in the orbits of satellites of the planets.

The possibilities of utilization of the method of approach and docking in interplanetary operations is not limited to the creation of permanent cosmodromes only. The spacecraft can be designed in such a way that they would themselves stay in orbit as the planet's satellite, and only a landing apparatus would make a descent to the surface of the heavenly body. It would have to approach and link up with the main craft later on, so the astronauts could rejoin the bigger unit. This scheme was selected by the American space specialists in their "Apollo" program.

The interplanetary craft does not necessarily have to land on the earth's surface while returning. It can moor at the orbital cosmodrome. This means that the interplanetary craft can do away with the cumbersome thermal safeguard; also special firmness of construction will not be required since the craft will not have to bear heat and dynamic loads, connected with entry into the atmosphere.

Another version is also possible: a special communication space apparatus

with a mighty engine and sufficiently big reserve of fuel, starts from the orbital cosmodrome or from the earth to meet the interplanetary craft. It links up with the interplanetary craft, takes all the necessary things. The travellers changeover to linked craft and return in it to the base or back to home. The interplanetary craft stays in orbit and can be used for another journey.

IF AN "SOS" IS SOUNDED

Apparently the orbital stations will not completely oust the automatic artificial satellites. (Even if they should, that time is still far off.) Therefore the problem of repair of satellites in the earth's orbit or even their complete replacement must arise. In fact even if an insignificant part of a costly satellite goes out of order, it would be more advantageous to send a repair spacecraft and replace the part than launch a new satellite. Only as a last resort would it be worthwhile to replace the old with a new satellite. The part could be restored after repairs at the base. The expediency of such operations will probably increase, and the repaired craft will be launched not from the earth, but from the orbital stations. During the early stage at least the repair or replacement of artificial satellites will require the compulsory exit of astronauts into open outer space. It is possible that later on special manipulators could be developed, which would allow the completion of all necessary jobs from a distance.

It may happen that the distress signal "SOS" will be sounded in outer space. There are a number of reasons capable of causing an accident; the fall of a meteorite, depressurization of the compartments, damage to the spacecraft at the time of docking, sudden illness of one or more of the astronauts. The possibility of this for an individual flight is very little, but with the increase in the number of launchings of manned spacecraft, the risk of accidents will inevitably increase in spite of the improvement in the reliability of the systems on board. It is also natural to assume that the aftereffects of the accident cannot always be removed by the astronauts themselves there and then. It is necessary to plan for an outer space rescue service.

This must have specialized systems, consisting of a mighty launch rocket, highly maneuverable rescue spacecraft and a wide network of earth station and command complexes. The character of the rescue operation depends on the type of accident. For example, if the resources of the lifesaving system are reduced or an astronaut falls seriously ill, the time for saving him would be very limited. It wouldn't be possible to wait for the moment when the point of launching of the rescue craft would pass through the plane of the orbit of the craft in distress. Therefore, it will be necessary to have duty-rescue craft on board the orbital station which may approach the affected spacecraft. When there are a number of stations with rescue spacecraft, the rescue service of the nearest station will come to the aid of the craft—just as the nearest

ship runs towards a ship in distress at sea, when it hears the "SOS" signal. The creation of special rescue stations is also not excluded.

After reaching the approach zone the rescue craft should quickly search out the craft in distress. In a number of cases it will not be an easy task, since the means for making the search easy may not be present, e.g. due to damage of the craft involved in the accident. Hence powerful radio-location and optical instruments should be fixed on board the rescue craft. It would be possible to use these at the stages of approach and docking after the search and "catching".

After the rescue craft approaches the distressed craft and stops, the crew would carry out an inspection. It would be ideal if it were possible to establish direct communications with the crew of the distressed craft and quickly find out the reasons for the accident and start the necessary corrections or evacuation of the astronauts. In cases where linkup is impossible, the exit of the astronauts into open outer space for carrying out the rescue operations would become essential.

IN THE NAME OF MAN

Our book has come to an end. Only one more important question remains to be answered: to what extent does the study and conquest of outer space affect our earthly affairs and scientific-technological progress?

This is what Professor M. Vasilev has to say on the subject:

"First of all it must be said that humanity's interest in the distant heavenly bodies and the desire to comprehend the laws of life of the universe has full justification. The planets of the solar system, including the earth, are parts of one world. Probably this world had a common origin, a common present and a common future. By studying the moon, Mars, and Venus, we comprehend our own planet in a better way and we find new ways of exploration and assimilation of its riches."

It was possible not only to enlarge and intensify space research, but also to put artificial earth satellites in the service of national economy because of the perfecting of rocket-space technology. Already the sphere of practical utilization of the artificial earth satellite system "Meteor", which ensures global observations of the processes in the earth's atmosphere, is giving

wonderful results. It has become possible to catch the telecasts of the central TV in the most distant corners of the country because of the satellite "Molniya-1" and the system of receiving stations "Orbits". A steady telephone-telegraph connection, earth-outer space-earth, has been established.

The artificial earth satellites are capable of improving and facilitating aircraft navigation and direction of ships in the open seas. Outer space apparatus can carry out patrol duties to guard our forest wealth. The television eye of the satellite and its instruments can notice not only the fire, but also the parts of the forest hit by harmful elements. The satellites can play an important role in geology, particularly in the exploration of useful minerals.

At the present moment hundreds of satellites are orbiting around our planet. Their utilization for the purposes of pure and applied science shows clearly that already astronautics is bearing fruit.

Here let me quote the words of Yu.A. Gagarin which have been preserved in the draft of a report he never lived to read.

"Penetration into outer space, like the other great deeds of humanity, should not be looked at only through the prism of every day interests and current practices. If people in the course of history were guided only by the desire to satisfy their daily needs, then humanity, probably, would have continued to lead the cavemen's life even today."

The scientific research program being conducted by the satellites of the "Cosmos" series, envisages study of the diffusion of radiowaves in the ionosphere, study of the earth's radiation belt with the aim of evaluating the danger from radiation during a prolonged flight in outer space, study of the magnetic field of the earth, sun and other space bodies, shortwave radiation, the higher layers of the atmosphere, the working out of the construction of outer space apparatus and the action of meteorite materials on these constructions. Even this list does not exhaust all the problems being decided by the satellites of the "Cosmos" series.

The creation of the automatic stations "Luna-16" and "Luna-17" opens new perspectives of space research. These unique experiments which tested automatic means of boring, collecting and bringing of lunar soil to the earth, and the tele-controlled self-propelling machine "Lunokhod-1" for movement on the moon's surface, have confirmed the effectiveness of space research with the help of automatic apparatus.

The results of space research and the achievements of rocket-space technology have an increasing influence on scientific-technological progress with the passage of each year.

Now it is perfectly obvious that one of the directions of the further development of astronautics will be the construction of long-duration orbital stations and outer space apparatus for supplying them. Much attention is being paid to this matter since the scientific and economic results of such stations will be

very substantial.

Scientists consider that taking out research to the near-earth orbit will have a great influence on the further development of such sciences as geophysics, astrophysics, astronomy, geology, geography, meteorology, biology and medicine. The speedy carrying out of various global investigations and observations will have a beneficial effect on the further development of these "earthly" sciences.

(Contd. from front flap)

been made, many records broken, and new records established in the space race between the world's two great space giants.

This book is devoted to the decade since the day of the historic flight by Yurii Gagarin. The book tells about all the Soviet astronauts, their lives, aspirations and exploits. The matter has been presented in a very lucid narrative style and the authors of the book have established intimate rapport with the astronauts. It also presents short biographical sketches of Russian astronauts.

The presence of Gagarin is felt throughout the book because he started the starry hour of humanity's venture into space. His space comrades strive to multiply our successes in understanding and conquering the universe with their efforts and knowledge.